

St. John's Hospital

*Report of the Pathological
Department*

St. John's Hospital



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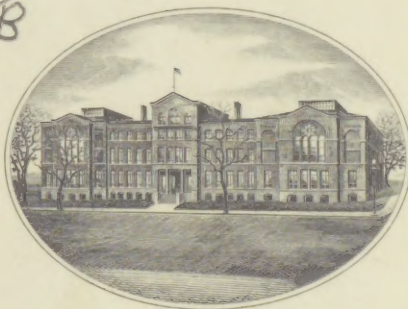
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*Report of the Pathological
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St. John's Hospital



WALTER G. BAIN, A. B. M. D.



*Springfield, Illinois
January, 1916*

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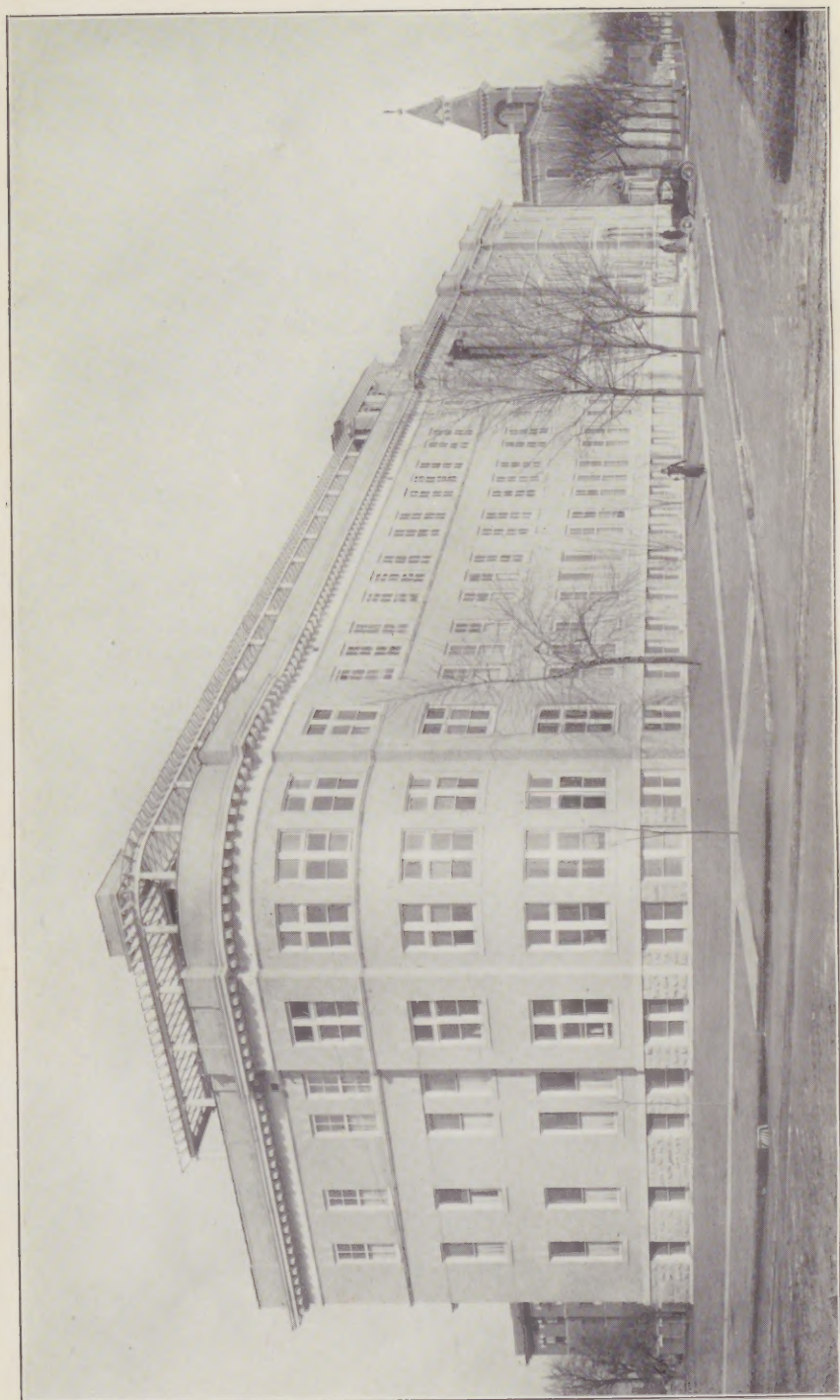
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NEW ADDITION TO ST. JOHN'S HOSPITAL.

LETTER OF TRANSMISSAL.

REV. JOSEPH C. STRAUB,

Director of the St. John's Hospital.

I herewith submit a report of the Pathological Department of the St. John's Hospital. This report consists of a detailed description of the rooms and equipment devoted to the work of this Department, the methods of procedure in detail, and a description of the system of recording, filing and preserving records.

It has been my endeavor to put the material in this report into such a form that if you desire to publish the same, it will constitute a handbook for the physicians patronizing this Department, from which they can readily determine the extent and limitations of the work that can be done for them.

I have had many inquiries from persons interested in this class of work in other institutions, and the publication of this report, therefore, would make a convenient way to supply them with the information they desire.

Trusting that this report will meet with your approval, I am,

Respectfully,

WALTER G. BAIN,
Pathologist.

THE RELATION OF THE SCIENTIFIC DEPARTMENT TO THE GENERAL PRACTITIONER.

Ever since the introduction of laboratory methods in diagnosis, both the laboratory worker and the general practitioner have experienced difficulty in reaching common ground as to the interpretation of the laboratory findings. There is a reasonable explanation for this. Oftentimes the physician in general practice is unfamiliar with the technique of the test which he has had made, and hence is unable to know the limitations of the results obtained in the laboratory. This is especially true since different authors vary in the technique they describe for certain procedures with a resulting difference in limitations of error. It is to overcome, as far as possible, this difficulty, that I have undertaken to compile in this report a complete outline of the methods of procedure as practiced in the Pathological Department of St. John's Hospital.

As a further evidence that the general practitioner is not familiar with the value of scientific work in diagnosis, I present the following: I have recently compiled from the records in the institution two sets of statistics, the one to show the relation of examinations of scientific nature made on patients as requested by the attending physician, and the other to show the number of examinations indicated on carefully studied cases.

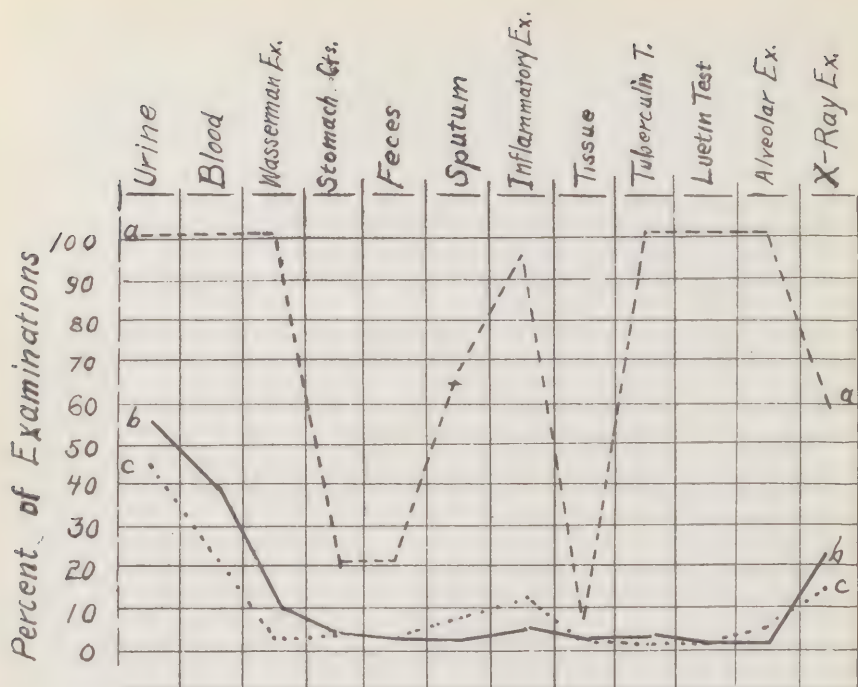
On page 9 is a graphic illustration of these statistics, wherein the lines cc and bb show the number of examinations and the character of the same, made on 8,000 and 4,500 patients respectively, consecutively entered in the Hospital. The line aa shows the number of examinations made on 250 cases,* selected for the purpose of diagnosis, wherein all scientific procedures available were resorted to. A careful study of this data gives one not only an idea of the neglect of scientific methods by the general practitioner, but also an idea of the future of what the Scientific Department will be to the attending physicians.

That the physician may derive the greatest value from the work of this Department, I believe it is essential for him to have at hand the exact description of the technique upon which the laboratory report he is intending to use in the diagnosis of his case, is made. It is also important to him that he be able to compare the results of the examinations on one person with those on another. Therefore, it is essential that the laboratory work be standardized as to technique, so that uniform reports can always be returned to the attending physician. For that reason it has been, and will continue to be, the aim of this laboratory to standardize and maintain some *one*, well-known, well-proven method for each routine procedure.

*Studied by Drs. A. R. Trapp and W. G. Bain.



APPROACH TO LABORATORIES



a, percent of examinations in properly studied cases based on records of 250 cases; b, b, in 4500 cases entered in the hospital 1915; c, in 8000 cases entered 1913 and 1917

In addition to maintaining practical procedures which are standardized, the work must be handled in such a manner that the report can be returned to the physician in the shortest possible time. In selecting methods of procedure, I have therefore been careful to choose the quickest method.

Inasmuch as this work has been established and carried on to meet the demands of the attending physician, who is not primarily a man of theory, and who is not as a rule carrying on any line of research other than making general deductions from similar cases, it has seemed to me that there would be no place in a routine laboratory of this kind for research work. Only such scientific work, therefore, is undertaken for the assistance of the attending physician as can be completed within a few hours after he discovers need for the same. In making this explanation I do not desire to in any way belittle the research work of medicine, either in connection with the hospital, or otherwise, but only to express myself of the view that such work ought to be done separately from the routine work required by the attending men, and also ought to be financed by

endowment, or otherwise than by the earnings of the laboratory itself.

Thus, the basic principles of establishing a scientific department for the modern hospital are two: First, the department must be a thorough business organization, self-supporting and prompt in attending to the needs of the physicians patronizing the same;



LABORATORY CORRIDOR

and second, the work must be limited in extent to the use of practical procedures which have to do with the bringing to light of pathological conditions in the patient under observation at the time the work is required.

HISTORICAL SKETCH OF THE LABORATORY.

This department was established in November, 1910. As stated in the introduction, the object of organizing a department of this kind was solely for the purpose of making available to the attending physicians scientific procedures which are too cumbersome, or too technical for routine office practice.

First a small clinical pathological laboratory was equipped on the second floor of the hospital. Soon afterward an X-ray machine was installed in the basement.

It has always been my aim to make only such examinations as have been proven to be of absolute practical value; no research work has been undertaken. Of the routine work some 20,000 examinations had been made up to the opening of this new, extensive department.

The X-ray work up to this time had been carried on in nicely arranged rooms in the basement, where we were using a 4 K. W. Interruptless machine with all of the newest and best accessories. In this department also, only such work as has been of material aid in diagnosis and treatment, was undertaken. All the plates have been filed and indexed so that they are easily available for reference, study and comparison. Previous to the installation of our new X-ray department, about 3,000 radiographs had been made.

Two years ago the work of the Scientific Department had increased to such an extent that the necessity of re-equipping the entire department was evident, so that plans for the present arrangement were made at the time of making of the plans for the new addition to the St. John's Hospital.

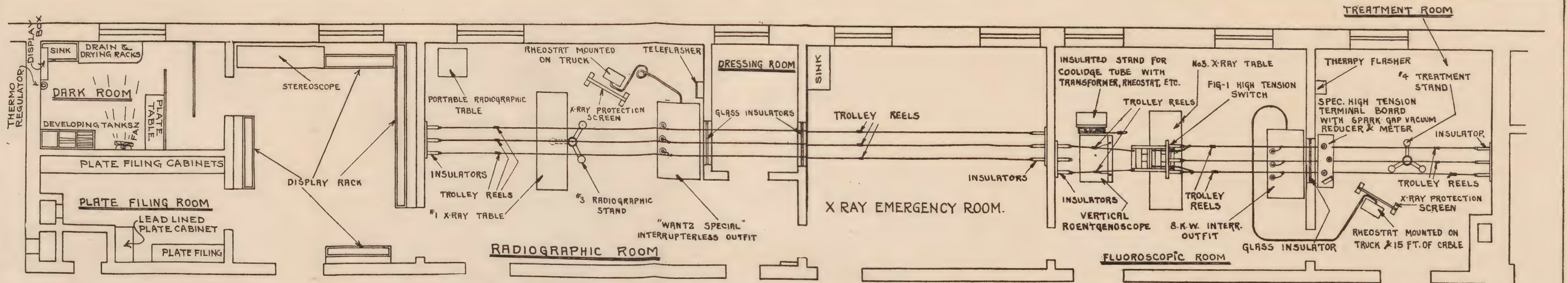
The X-ray parlors and laboratories of the present department are located in the basement of this new addition. Fourteen rooms have here been furnished and equipped to carry out the work along the lines previously suggested. The X-ray rooms consist of a room for operating the X-ray machine; a treatment room; a radiosopic room; a small surgical room for emergency fracture work, urethral catheterization, etc.; a dark room; plate filing room; a dressing room, and a therapeutic room.

The space for use in the clinical laboratory work includes a room for the general routine laboratory work, a private laboratory, an office for the pathologist, and a room for receiving and classifying specimens and making up reports. A plan giving the general arrangement of these rooms is shown on page 10. In making the plans for the rooms for this work, there was kept constantly in mind the necessity of having several persons employed in the same room at different classes of work. Therefore, the arrangement of rooms, work-tables, and equipment is such that sixteen persons can employ themselves at different classes of work without interference in securing materials and making use of equipment.

During the time that the new laboratory has been in operation it has been found that the care exercised in arrangement has made for efficiency and economy, both of time and material.

Before taking up a detailed description of the work of the department, I wish to acknowledge my indebtedness to Mr. John McIntosh of the John McIntosh Company of Chicago, for his aid and advice in the selection of the X-ray equipment and the installing of the same.

Mr. McIntosh is one of the pioneer radiographic experts of this country who has made a special study of the mechanics of X-ray science. In following his advice, therefore, I believe that I have selected the best constructed, the most economical, and most consistent X-ray outfit that has ever been installed in any institution in the country.

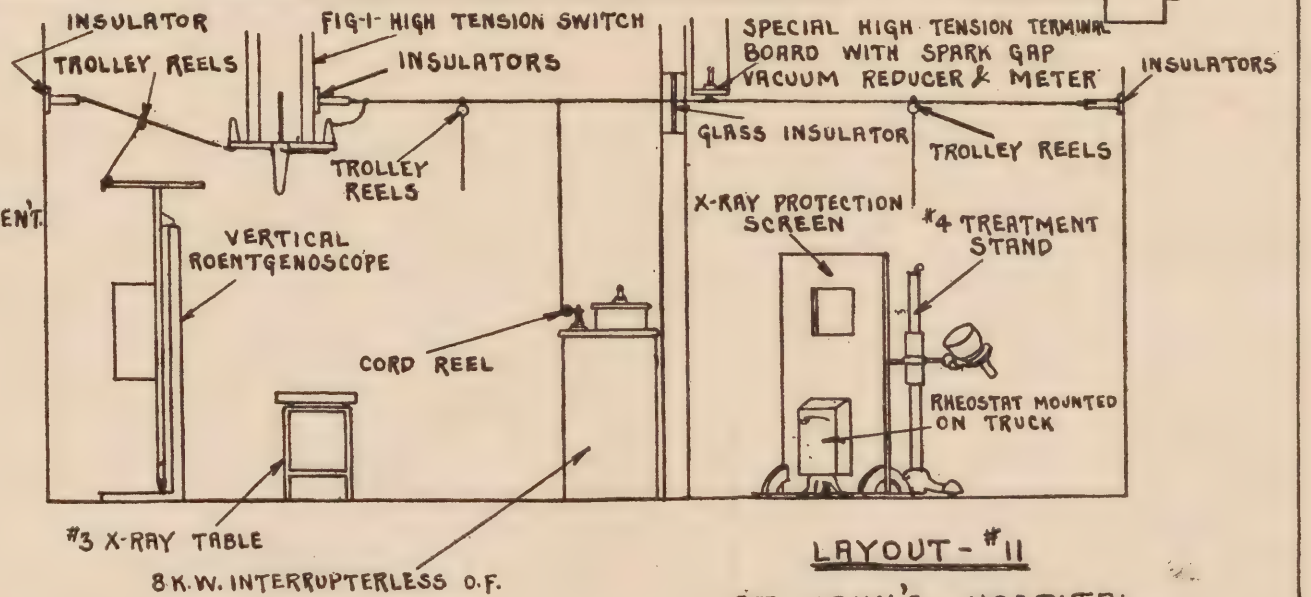


- 1- "WANTZ SPECIAL" INTERRUPTERLESS OUTFIT WITH RHEOSTAT MOUNTED ON TRUCK & 15 FT. OF CABLE
 1- 8-K.W. INTERRUPTERLESS OUTFIT WITH RHEOSTAT MOUNTED ON TRUCK & 15 FT. OF CABLE
 1- STEREOSCOPE
 1- PLATE DISPLAY RACK (4 FT. LONG)
 1- " " " (11 FT. ")
 1- No.1 X-RAY TABLE
 1- No.3 RADIOGRAPHIC STAND
 1- TELEFLASHER
 2- X-RAY PROTECTIVE SCREENS
 1- PORTABLE RADIOGRAPHIC TABLE (PLAIN TOP)
 3- GLASS INSULATORS
 13- TROLLEY REELS
 2- OVER-HEAD WIRING SYSTEMS
 1- INSULATOR FOR OVER-HEAD WIRING SYSTEM

LIST OF APPARATUS REQUIRED

- 1- INSULATED STAND FOR COOLIDGE TUBE
 1- TRANSFORMER " " "
 1- RHEOSTAT " " "
 1- A.C. AMMETER " " "
 1- CATHODE TERMINAL " " "
 1- DUPLEX REELS WITH UNIVERSAL JOINT & PIVOT
 1- SPEC. HARD RUBBER SUPPORT FOR DUPLEX REELS
 1- VERTICAL ROENTGENOSCOPE
 1- No.3 X-RAY TABLE
 1- FIG-1- HIGH TENSION SWITCH
 1- SPECIAL HIGH TENSION BOARD WITH SPARK GAP VACUUM REDUCER & METER
 1- THERAPY FLASHER
 1- No.4 TREATMENT STAND
 150 FT. COPPER WIRE
 1- SET OF 4 ALUMINUM FILTERS

- 1- A TREATMENT DIAPHRAGM
 1- B " " " "
 1- C " " " "
 1- D " " " "
 1- 11"X14" FLUOROSCOPIC SCREEN FOR VERT. ROENT.
 1- KIDNEY COMPRESSION CAP
 1- 8"X10" INTENSIFYING SCREEN
 1- 14"X17" " " "
 1- 8"X10" METAL CASSETTE
 1- 14"X17" " " "



LAYOUT - #11

ST. JOHN'S HOSPITAL
 SCALE $\frac{1}{4}$ " = 1 FT. SPRINGFIELD - ILL

PART I.

THE X-RAY DIVISION OF THE WORK.

The X-ray work can be conveniently divided into three classes: the Radiographic, the Radioscopic and the Radiotherapy.

The Radiographic work is divided into four classes: 1st, exposure of the plate or film; 2nd, technique in the dark room; 3rd, demonstration room for demonstration and study of the finished negatives; 4th, filing negatives for future reference.

We have made this division in our department and have devoted a separate room to the conducting of each of these separate classes. There follows a description in detail of the equipment, general methods, and technical conduct in each of these separate rooms.

RADIOGRAPHIC ROOM.

The Radiographic room has two windows on the north, and is entered by three doors, one opening into the Demonstration room, one into the Emergency Fracture room, and one from the hall. In this room, as well as in all of the other rooms of the X-ray department, the walls are finished in Delft blue, which I have found to be exceedingly well adapted for the lighting conditions desired in this work.

In this room is installed the following equipment, placed as indicated on page 10.

- 20 K. W. Transformer.
- Teleflasher.
- Battery of Tubes.
- Lead Box which will take 14x17 Plates.
- Victor Table.
- Victor Tube Stand.
- Overhead wires which also extend into Emergency Room.
- Small portable table.
- Small white enamel table.
- Waste basket for dressings.
- Set of steel plates to place under glass plates.
- Compressor with a centering device.
- Diaphragm chart.
- Distance and stereoscopic chart.
- Rheostat mounted on rollers connected to the machine by theatrical cable.
- Protection screen.
- Four chairs.
- Cuspidor.
- Lead alphabet for numbering the plates.

On a little table at the side are kept a number of blanks for the X-ray work, numbered and in duplicate with a carbon between,



VIEW OF RADIOGRAPHIC ROOM, SHOWING TRANSFORMER

the corresponding lead numbers stuck on each by means of a small piece of adhesive at the bottom, ready to be photographed on a plate when the radiograph is required.

TECHNICAL CONDUCT.

1. Secure history of patient.
2. Prepare proper size plate and place in lead lined box.
3. Start the transformer.
4. Select the proper tube and place in tube stand.
5. Test tube and adjust vacuum.
6. Center tube on table.
7. Place patient on table.
8. Inspect the desired anatomical part.
9. Decide on factors "S" and "T", or "S and "B" of formula on page 19.
10. Solve equation and place Rheostat on Button "B".
11. Put plate in position.
12. Adjust position of tube.
13. Make proper exposure.
14. Look after comfort of patient.
15. Withdraw plate and take to Developing Room.
16. Turn out lights with Dark Room control and place in developing tank.
17. Transfer to fixing solution, wash and examine.
18. Record interpretation, file number, and catalog plate.

After the entrance of the patient, one of the blanks is filled out complete if the patient is not in a critical condition, and if time permits.

In case of infant in arms, it is better to place the child in the arms of the mother, or parent, and put the plate between the part of the child desired to radiograph, and the parent. If it is a chest or abdominal view of the child, it is better to place the child with its arms around the mother's neck, if necessary having the mother lie on the table with the child on her chest.

In case the patient is unconscious, instantaneous pictures should be made if possible, or if the patient is having spasms.

A patient, if semi-conscious or very ill, ought not to be left alone in the Operating Room, nor a child. Another attendant should be called to watch the patient while the plate is being developed, if the attending physician or some friend is not present.

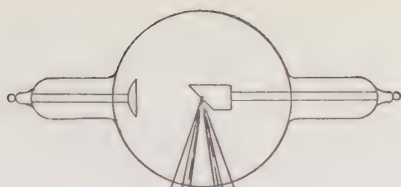
If the patient is in a critical condition, or time does not permit a complete filling out of the blank, such information should be obtained from the patient as will be necessary to guide the operator in the choice:

First, of a tube;

Second, the size of the plate;

Third, the distance of the target from the plate;

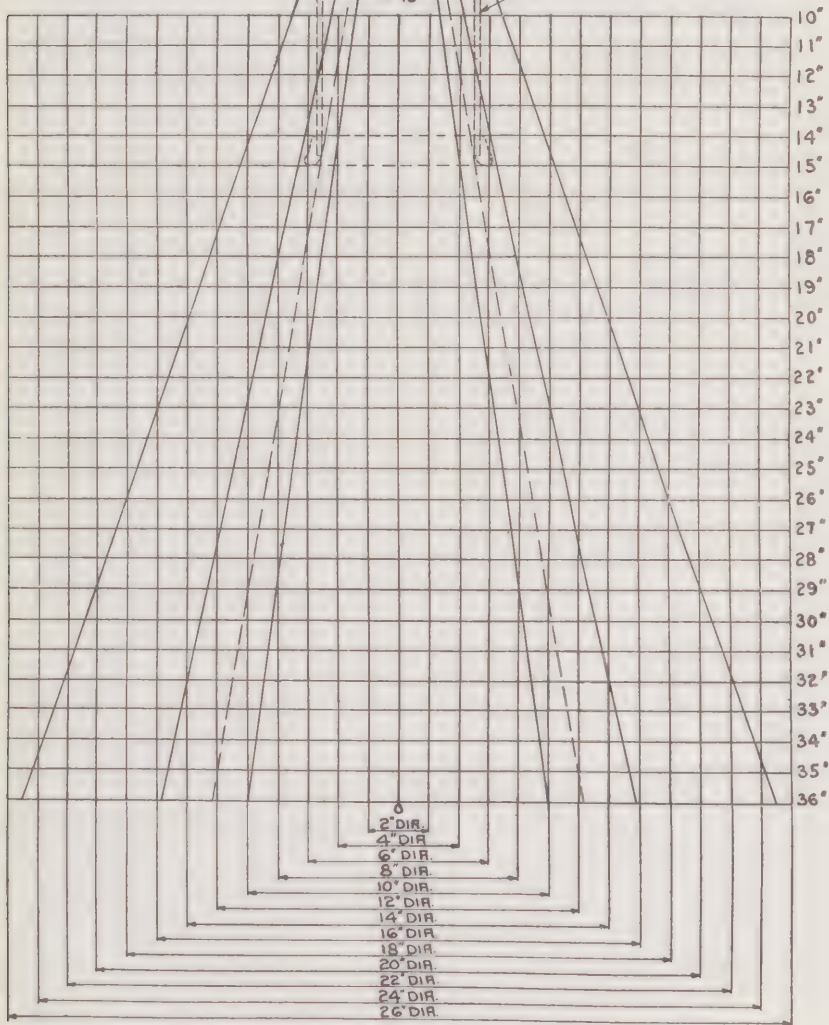
Fourth, the time of exposure.



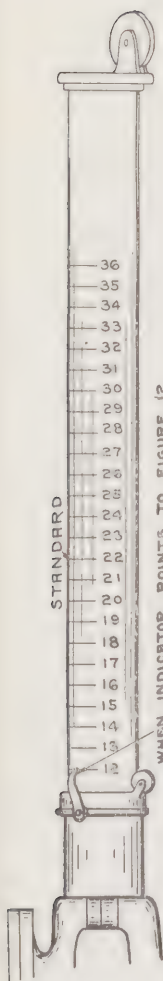
DIAPHRAGM CHART

DIAMETERS OF DIFFERENT
SIZED OPENINGS IN DIAPHRAGMS

COMPRESSION CYLINDER

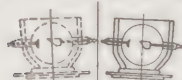


DIAPHRAGM CHART



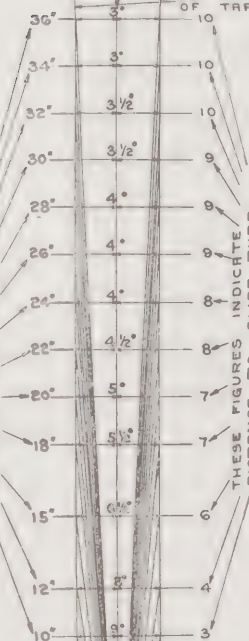
WHEN INDICATOR POINTS TO FIGURE 12
ON STANDARD THE CENTER OF TARGET
IS 12" FROM PHOTOGRAPHIC PLATE
WHEN USED WITH THE VICTOR XRAY TABLE

THESE FIGURES INDICATE
DISTANCE TO TILT TUBE
EITHER SIDE OF CENTER



CENTER LINES
OF TARGET

THESE FIGURES INDICATE
DISTANCE BETWEEN TARGET
OF TUBE AND PLATE



NOTE:-

THE DISTANCE BETWEEN
CENTERS OF TARGET WHEN
TUBE IS TILTED EACH WAY
IS ALWAYS $2\frac{1}{2}$ " REGARDLESS
OF THE DISTANCE BETWEEN
TARGET AND PHOTOGRAPHIC
PLATE.

THESE FIGURES INDICATE
DISTANCE TO SLIDE TUBE
EITHER SIDE OF CENTER

PHOTOGRAPHIC
PLATE

CENTERING CHART.



VIEW OF RADIOGRAPHIC ROOM. SHOWING CONVENIENCE OF
OVERHEAD WIRING

The button on the Rheostat for each particular case is obtained by the application of one of the following formulas. The first if it is desired to operate on a low button, the second if it is desired to operate in the shortest possible time.

$$T = \frac{S}{\sqrt{B - (M + \frac{D^2}{M^2})}}$$

$$M + \frac{D^2}{M^2} + \frac{S^2}{T^2} = B, \text{ wherein}$$

“M” equals the milliamperes that the tube will take adjusted according to the class of tissue one desires to skiagraph; bone tissue requiring a tube carrying ten milliamperes on Button 7; abdominal tissue requiring a tube carrying fifteen milliamperes on Button 7; and kidney, lung and other soft tissues requiring a tube carrying fifteen milliamperes on Button 7.

“D” equals the distance of the target from the plate as obtained from the diaphragm chart, page 16.

“T” equals the time in tenths of a second, which is determined by the class of tissue we desire to skiagraph. The movements of the chest require the shortest time for lung and heart work, a tenth of a second or less is preferable. Abdominal work should be done in not to exceed a quarter of a second. Kidney work can be lengthened to a half second or more, and bone work to one second or more.

“S” equals the thickness of tissue, or the relative resistance of tissue. Thus in a child under ten years of age, the thickness of the part, although actually measuring four inches, ought to have a relative value of three. The “S” in a man sixty years of age, emaciated from the debilitating effects of carcinoma, although measuring through the abdomen seven inches, ought to have “S” figured as twelve inches. For lung tissue, although the patient measured through the chest nine inches, “S” would have a value of five inches.

Then “T” in the solution of the first equation, is the number of tenths of seconds, and “B”, the solution of the second equation, gives the button on the Rheostat.

Having determined these facts and made a record of the same on the blank, the tube for use is selected and placed in the stand, the switches are thrown in in the following order, and its milliamperage adjusted:

Wall switch.

Transformer main switch.

Motor switch.

Reversed in 10 seconds.

Polarity switch.

Rheostat switch.

Polarity is determined with Teleflasher with Rheostat on Button 7, using the Rheostat Switch.

Teleflasher shunt is now opened, and tube operated with the Teleflasher Button.



V I E W I N R A D I O G R A P H I C R O O M , S H O W I N G T U B E S T A N D

THE DARK ROOM.

The Dark Room is equipped with the following:

Developing Tank.
Sink with Drain Racks.
Macalaster-Wiggin Alarm Clock.
Plate Changing Stand.
Wiring in accordance with plan.
Electric Fan.
Plate Holders.
Plate Rack for Drying.
Hydro Thermo Regulator.

The dark room is entered by a maze of two passages 24 inches wide. The lighting of the dark room is done by means of a red overhead light, and an 18"x18" demonstration box. There is also a red lamp over the developing tank. There is a 3-way switch at the entrance and at the end of the maze, controlling the entire lighting system. There is a cut-off switch, giving a separate and complete control over the filling cabinet. The filling cabinet consists of a base similar to the one described for the demonstration room, except that the four-inch shelf is not present. The red light over the developing tank is connected by a separate circuit. There are also electrical connections for a fan in this room.

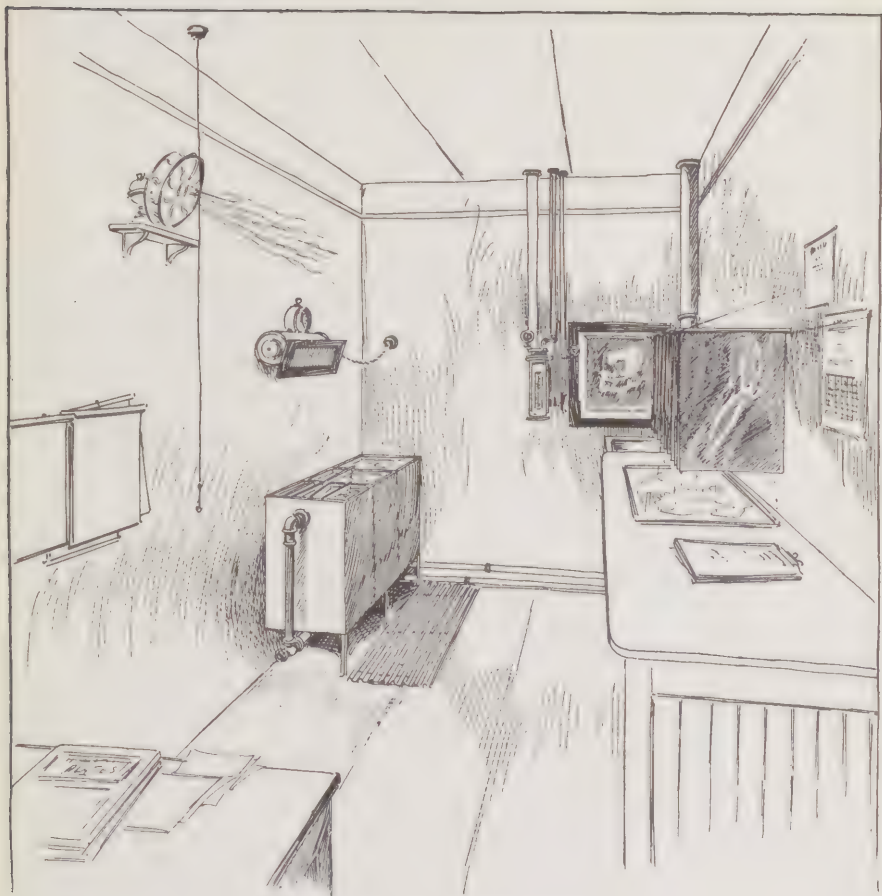
The developing tank has five compartments, the size of which are as follows: Two 15"x13"x22" deep, and three 4"x15". Of the three, one is used for strong developer, one for weak developer, and the other for washing. Between this set of three and the end of the tank is one for washing plates, and the end is used for hypo solution. There is also a sink and drain-board. Over the drain-board are hooks to hang the plate-holders.

TECHNICAL CONDUCT.

The developing tank is connected with a hot and cold water regulating tank, by which any temperature can be held constant.

Before exposing plates for development or for filling envelopes, the entire lighting system is cut off by the overhead switch provided for that purpose. Plates for developing are taken from the envelopes, slid into the plate-holder, and then immersed in the tank developer, the alarm clock having been set for the time of developing. At the end of the proper time the plate is examined, and if developing has progressed as it should, plate is rinsed and transferred to the fixing bath. Fixation completed, it is transferred to the wash bath, and hung up in front of the fan to dry.

The developer is kept fresh and renewed as often as necessary, its condition being determined by occasionally developing an unexposed plate.



SKETCH OF DARK ROOM

The following formula is used:

Water	6 gallons
Elon	1 ounce —330 grains
E. K. Co. Sulphite of Soda.....	38 ounces—175 grains
Hydrochinon	7 ounces— 9 grains
E. K. Co. Carbonate of Soda.....	38 ounces—175 grains
Potassium Bromide	307 grains

This formula is recommended where developing is done by the tank method, with normal time of five to seven minutes at 65° temperature.

The Acid Fixing Bath may be prepared as follows:

Water	16 ounces
Hypsulphite of Soda	4 ounces
E. K. Co. Sulphite of Soda.....	¼ ounce

When fully dissolved add following hardener:

Powdered Alum	$\frac{1}{8}$ ounce
Citric Acid	$\frac{1}{8}$ ounce

After fixing, plates should be placed in running water for 15 or 20 minutes.

Each plate, before being put into an envelope or into the screen, should be brushed with a soft camels hair brush.

The Dark Room is ventilated, as are all other rooms in the institution, by a special system which furnishes a supply of pure air at all times. A fan is utilized for keeping the air in circulation.

The convenience of arrangement is such that an operator may handle several dozen plates in a very short period of time.

THE DEMONSTRATION ROOM.

The Demonstration Room is equipped with a stereoscope, whose legs are 4" high. This is placed on a base, the top of which is 16" wide, sixteen inches below which is another shelf. The space between the two is divided into compartments 8" wide. Beneath this set of compartments is another set divided into compartments 18" high and 25" wide. This entire base stands on legs 9" high.

The rest of the available wall space of this room is taken up with demonstration boxes 19" wide, and of lengths to fit in the open spaces, and these set on bases similar to the one described for the stereoscope. These boxes are equipped with two Tungsten lamps to each 12" of length, each alternate lamp on a different switch so that we have two variations of the light. One section of the demonstration box is placed against the window, which gives the soft daylight for studying plates. The light is furnished through opalescent glass in the front. The fronts of these boxes are hinged above and can be easily opened to make any changes required in the lamps. The inside of all of these boxes is painted with aluminum paint.

A rack is placed in front of the box next to the Dark Room so that plates can be examined before they are dry. This rack extends out beyond the edge of the base so that water dripping will drop directly on the floor, which is absorbed by a rug laid there for that purpose.

The Demonstration Room with its several demonstration boxes, affords a very convenient system of diagnosing the plates which are brought from the Dark Room, after they are dried, placed in the rack and studied in the demonstration boxes and a diagnosis written on the blank which has previously been filled out.

DEMONSTRATION ROOM



THE FILE ROOM.

The File Room is equipped with a series of racks similar to the bases described for the Demonstration Room except that the second shelf of this base is 18" high. On this base is set three rows of shelves 12" high divided into compartments 8" wide. These are used for filing the 8"x10" plates, and a shelf below for filing the 10"x12" and one for 14"x17" plates. The room also contains a cabinet with four shelves, respectively 9", 14", 16" and 18" high. The depth of this cabinet is 11" and the width is 28". It is lined through-



FILE ROOM

out with sheet lead $\frac{1}{8}$ " thick, including the doors. This cabinet is used for unexposed plates.

The exposed plates are filed in manila envelopes open at one side with the upper open corner cut off about $\frac{3}{4}$ of an inch back. There is no printed matter on these envelopes, which are of three sizes to easily receive an 8"x10", 10"x12", or 14"x17" plate. The plates are filed serially, and the serial number is placed on the upper left hand corner so that it is visible when the plate is put in the

envelope described above. The description is not on the envelope but on the record, the number of which is photographed on to the plate. There is thus no confusion brought about by putting the plates in the wrong envelopes. The shelves are numbered "A", "B", and "C", according to the respective sizes of the plates, 8"x10", 10"x12", and 14"x17". The plates are indexed for future reference as described later in connection with the description of the clerical work.

THE RADIOSCOPIC ROOM.

The Radioscopic Room is next to the Radiotherapeutic Room, into which room it opens, and which room is wired with overhead high tension wires from the No. 2 Victor Transformer used for the radioscopic work.

In addition, the following equipment is to be found in this room:

Horizontal Roentgenoscope equipped with Coolidge tube.

Upright Roentgenoscope equipped with Coolidge tube.

Transformer, for energizing the Coolidge tube, with rubber-tired rollers connected with the theatrical cable.

Foot Switch cuts in transformer or the blue light overhead.

Rheostat mounted on rollers and connected with the theatrical cable.

Protection Screen.

Foot Stool for the patient standing in front of the Horizontal Roentgenoscope.

Stool for the operator.

White Enamel Table.

Two Chairs.

Lead Apron, Gloves and Lead Protection Mask.

The Transformer in this room is at the center of the right wall as you enter from the hall. The overhead wiring for high tension runs from one side of the room to the other, directly over the Transformer, the wires passing through an insulation in the wall back of the Transformer into the Treatment Room.

At the left stands the Upright Roentgenoscope. In the center of the room, just under the wires, is placed the Horizontal Roentgenoscope. The Transformer for the Coolidge Tube can be moved from near one of these pieces of apparatus to another, or can be moved to the Treatment Room. The cable is of sufficient length and the base plugs are conveniently arranged for this purpose. The foot switch is connected with cable of sufficient length so that it can be used either by the operator when standing in front of the Upright Roentgenoscope, or when examining a case on the Horizontal Roentgenoscope. The convenience of this arrangement can be observed by examining illustrations on pages 27 and 29.



HORIZONTAL ROENTGENOSCOPE

TECHNICAL CONDUCT.

1. Secure history of patient.
2. Have patient properly prepared.
3. Prepare bismuth meal.
4. Enter Radioscopic Room and try out equipment, throwing in switches as follows:

Wall Switch.

Transformer Switch.

Motor Switch for starting which is
Reversed in 10 seconds.

Coolidge Transformer is connected with its base plug.

Connection for the blue light is made with the base plug.

Polarity Switch on the Rheostat is then thrown in.

Overhead Switch.

Voltage Switch on the Rheostat.

Rheostat on C. Transformer is advanced.

Tube circuit is closed with foot switch.

5. Turn out the light and remain fifteen minutes in absolute darkness.

6. Without allowing light to be admitted, have patient brought in and placed in position in front of screen.
7. Proceed with routine examination as described below.
8. Enter findings on history blank.
9. Send patient to Radiographic Room for record.

This history and record of cases brought to the Radioscopic Room are made on the blank shown on page 67. All observations made in this examination are recorded as physiological observations on the blank. The description of the radiographs from these cases are recorded under anatomical records.

Before the actual examination is commenced everything is arranged for making a radiographic record, if it is desired in the course of the examination.

A bismuth meal, which is made up according to the following formula, is ready and placed on the table at the side of the room:

- 3 oz. Barium Sulphate
- 2 oz. Malted Milk
- 1 oz. Sugar
- $\frac{1}{2}$ oz. Mucilage of Acacia
- $\frac{1}{8}$ oz. Vanilla Extract
- 10 oz. Water

If there is an indication for a study of the colon by means of the bismuth enema, this is also fixed previous to commencing the examination according to the following formula, the ordinary enema outfit being used for the purpose:

- 4 oz. Barium Sulphate
- 1 oz. Acacia
- 2 oz. Malted Milk
- 16 oz. Water.

The patient having been brought into the room, the Coolidge Tube is energized by throwing in the switches as above outlined.

The patient, who has previously been undressed, is now placed in front of the Upright Roentgenoscope, and the examination proceeded with.

The inspection of the chest is made, including the inspection of the lungs, heart, aorta, mediastinum, and the diaphragm. The examination of each organ is proceeded with as follows:

The Lungs. Note first the density of the bronchus. Then the condition of the smaller bronchi as to density. A general survey of the lungs as to the consolidation that has taken place, whether general throughout both lungs, and the different lobes, whether single or multiple in one or more of the lobes. The condition of the lung as to congestion, whether active or passive, whether the condition exists in one lobe only, or in more. Record the number



UPRIGHT ROENTGENOSCOPE

of glands that are observed, the extent of infiltration, whether single or multiple. If cavities are present, record the size and number and location.

The Heart. Note the size of the heart as a whole, also enlargement of each auricle and each ventricle. The position of the heart, whether normal, whether transposed or displaced to the right, left, or up or down. Observe both vertically and transversely, the pericardiac sack, its size, density and outline, whether regular or irregular, and abnormalities of the cardio-hepatic angle.

The Aorta. Its size, its general condition as regards density, differentiating both the ascending portion, the arch and the descending portion, whether fusiform, its pulsations and expansions.

The position of the aorta, whether normal, displaced to the right anteriorly or posteriorly, the size of the retrocardiac space, whether diminished or enlarged. Record here the obstructing growths or deformities of the esophagus.

The Mediastinum. Its density, degree and size and location of the density, whether circumscribed, diffuse, regular or irregular.

The Diaphragm. The excursion of the diaphragm, whether normal, increased, diminished, or absent on both the right and left sides. The position of the diaphragm, whether normal, high or low on both right and left side. The contour of the diaphragm, whether regular, irregular, or broken.

The Digestive Tract. The examination of the digestive tract is now taken up. The bismuth meal is given after a general inspection of the abdomen has been made. In an X-ray study of the digestive tract the following anatomical parts should be examined and reported upon separately: The esophagus, the stomach, the duodenum, the small intestine, the colon, the rectum, the gall-bladder.

In the study of the **esophagus**, note the position, whether normal or displaced to the right, left, backward or forward. The patency, whether the opening is free, dilated; if dilated, whether at the upper, middle, or lower divisions, whether obstructed and the degree of obstruction, also the presence of the diverticulum, its size and position, whether to the right, left, anterior or posterior. The peristalsis of the tract, whether noted, normal, active or very active.

In the examination of the **stomach** note the tonus, whether hypertonic, orthotonic, or hypotonic. The filling defects, whether their location is at the cardiac end, the middle or the pyloric end; whether on the greater curvature or lesser curvature; whether on the anterior wall or posterior wall; whether the size and shape of a pocket. The form, whether fish-hook, steer-horn, hour-glass, organic, spasmodic, or deformed. The position, whether normal, displaced vertically, obliquely, transversely, to the right or left, up or down. Note whether or not there is a transposition or a diaphragmic hernia. The size, whether large, small, medium or very large. The mobility, whether fixed, slightly mobile, or mobile. The peristalsis, whether normal, active, increased; whether anti-peristalsis is present or the peristaltic wave is irregular. The incisura of the cardica is medium, pyloric; narrow, broad, deep or shallow; whether double, multiple, false or transient, and if it corresponds to the pain. The evacuation, whether complete after six hours or incomplete. If incomplete, the size of the residue. Also note the head or duodenal cap.

The **pylorus**, its position, whether normal, displaced to the right, left, up or down; and the mobility, whether fixed, slightly mobile, or mobile. The patency, whether free, gaping or obstructed, slightly or marked. The opening, whether it is immediate, delayed or not seen.

The **duodenum**, whether observed or not observed, the condition after six hours; whether small, medium, large or very large. The position, whether normal, displaced upward or downward, to the right or left. The mobility, whether fixed, slightly mobile, or mobile. The patency, whether free, dilated, obstructed, slightly or marked. The peristalsis, whether it is normal, active or hyper-peristaltic. The bulb, whether regular, deformed; its size, whether small, medium, large or very large, or not seen.

The **jejunum** and **ileum**; note the patency, whether normal, dilated, obstructed, kinked; if adhesions, tumors, foreign bodies, fistula, diverticulum or stasis after one or more hours. The peristalsis, whether normal, rapid, slow, frequent or infrequent.

The **ileo-cecal valve**; its competence, whether incompetent or obstructed.

The **appendix**; if visible, whether tender, fixed or retrocecal; the lumen, whether normal, wide, narrow, tortuous, curled, kinked or fistula.

The **colon**; its position, normal, displaced to the right, left, up or down; its rotation or transposition; its mobility, fixed, slightly mobile or mobile; its patency, normal, dilated, or obstructed; its peristalsis, whether normal, anti-peristaltic, or not seen. Miscellaneous observations, diverticulitis, fistula, adhesions, redundancy, filling defects, anomaly, foreign bodies, stasis, after one or more hours, observation after injection and evacuation.

The **rectum**; its patency, free, dilated, obstructed; impact, tumors, foreign bodies, adhesions or fistula.



RADIO THERAPEUTIC ROOM

RADIOTHERAPEUTIC ROOM.

The Radiotherapeutic Room is equipped as follows:

Overhead Wiring from the Radioscopic Room, carrying the high tension current for exciting the tube.

Victor Treatment Stand No. 2 with an assortment of millimeter aluminum disks and shutters.

Coolidge Tube and Victor Coolidge Transformer.

Victor Therapy Flasher for the Gauss deep therapy.

High Tension Terminal Board.

Necessary Lead Protecting Sheets, Screens and a Wooden Treatment Table and Chair.

White Enamel Stand.

Clip Board for holding reports.

Time Clock.

The Victor Treatment Stand is placed beneath the overhead wires by the side of which is the table. The Transformer is placed just inside of the door leading to the Radioscopic Room, near which also is placed the Rheostat.

TECHNICAL CONDUCT.

1. Get history of patient.
2. Examine and note condition of parts for treatment.
3. Get statement of authorization for treatment from attending physician.
4. Secure white blood count, total 24-hour urea estimation and blood pressure, and record.
5. Connect up equipment as follows:
 - Throw in Wall Switch.
 - Transformer Switch.
 - Motor Starting Switch which is Reversed in 10 seconds.
 - Connect C. Transformer by its base plug.
 - Advance Rheostat on C. Transformer.
 - Throw in Polarity Switch which is Reversed if necessary.
 - Voltage Switch on Rheostat.
6. Place patient in proper position for treatment, select proper filters, set timing-clock and proceed with treatment, making required records of milliamperage, spark gap and time on a properly prepared blank.
7. Secure personal statement of patient as to his condition, recording same on record in quotation marks.

The tube is energized by throwing in the switches as above described.

The time of treatment and the duration of treatment is, of course, dependent on the history of the condition and the desires of the attending physician. A history, however, of the case is taken on the blank provided for that purpose. A careful diagnosis of the condition is absolutely necessary before treatment is begun.

It would seem from observations that have been made on the effect of X-ray that the action of the ray is one of disintegration of chemical substances in the body. The beneficial results come from the indirect effect on metabolism, as well as from the direct effect of the ray. It is therefore necessary to watch the general condition of the patient, as well as noting carefully before each treatment the local condition. The basis of control of the general effects is to watch the white blood count, which is lowered by over-treatment, the blood pressure, which is lowered by over-treatment, and the urea excretion which is increased by over-treatment. Therefore, at frequent intervals in a course of treatment, a white blood count and differential must be made, the blood pressure taken, and the quantitative estimation of the urea of the 24-hour specimen of urine made.

The blank used in connection with this work provides for recording these various examinations, as well as the quantity of ray as measured by the spark gap, milliamperage, and time of treatment, is shown on page 68.

RULES FOR SUPERFICIAL TREATMENT.

20 cm. focal distance.

2 milliamperes backing up 3" spark gap from 3 to 15 min.

Repeat as local condition indicates.

RULES RELATIVE TO THE DEEP TREATMENTS OF THE X-RAY.

3 mm. aluminum filter.

Leather filter.

20 cm. focal distance.

3 milliamperes of current cross-fired backing up 9" spark gap until the erythema dose has been given.

For abdominal work a binder should be placed on the patient, and the hips elevated, thus removing the intestines from the direct line of the rays.

X-RAY EMERGENCY ROOM.

This room is a small operating room which is wired overhead from the 20 K. W. transformer of the Radiographic Room. It contains the following equipment:



X-RAY EMERGENCY ROOM

Table on which the patient is placed.
Stand for hand solutions.
Small Instrument Case.
Sink.
Two Small Tables for placing dressings, etc.
Jones Scale.
Stools.
Gas Oven.
Spirometer.
Basket for soiled dressings.
Cuspidor.
Two Stools.
Two Chairs.

There are also the necessary bandages and splints for fracture work.

This room is used for making general physical examinations of the patient, for taking blood for Wassermann test, securing specimens for autogenous vaccines, for removing stomach contents, for removing small portions of tissue for examination, for administering Luetin and Tuberculin tests, and for catheterization when it is desirable to take radiographs of the catheter in place. We have found constant use for this room in connection with the work of this department.

The lighting for this room consists of three rose sockets in which a drop light is placed, a white light, and a rheostat for the esophagoscope.

DRESSING ROOM.

The **Dressing Room**, located between the Radiographic Room and the Emergency Room, is equipped with toilet, mirror and wash stand.



DRESSING ROOM



ELECTRO THERAPEUTIC ROOM.



ELECTRO THERAPEUTIC ROOM.

ELECTRO-THERAPEUTIC ROOM.

The equipment consists of :

Static Machine.

McIntosh Wall Plate for galvanic, faradic and sinusoidal currents.

Victor No. 8 for diatherma, auto-condensation and high frequency.

Victor Vibrator for mechanical massage.

To which it is the intention to add in the near future a Victor-Bergonie apparatus for treatment of obesity, diabetes, rheumatism and passive ergotherapy.

In the handling of cases in this work, the treatments are given entirely in accordance with the directions of the attending physicians.

PART II.

CLINICAL PATHOLOGY.

The purpose of going into detail in giving methods practiced in the laboratory is this: A physician sending material for examination, or having patients in the hospital for care and desiring examinations done, can by referring to this outline, see exactly the procedure used in making the reports upon which he desires to base his diagnosis. Every laboratory worker knows that it is important for the making of laboratory interpretations to know the method used, and when it is done repeatedly, to have the same method followed in every case.

The description of methods, or procedures, which follow are in no way intended to be complete or exhaustive. On the other hand, they represent the minimum of technique which is necessary in meeting the demand of the Clinical Pathological Department. Even though the major part of this work can be handled in the routine laboratory and by routine methods, to make the organization



WEST END OF GENERAL LABORATORY

complete a special laboratory is necessary. In this laboratory can be handled the trying out of new methods, the compounding of reagents for the routine laboratory, and the performing of tests which require a very high degree of technical training and experience in interpretation.

THE URINARY ANALYSIS.

There are several general facts, which bear upon the interpretation of the analysis, which are well to have in mind before undertaking the routine analysis of a sample of urine. In the interpretation of urinary analysis with reference to renal disease, albumen and casts may be entirely absent and yet, according to Janeway, the blood pressure will show severe kidney disease. It frequently happens that albumen is absent and the microscopical examination shows abundance of casts. Since diet, exercise and the amount of fluid ingested has so much to do with changing the character of the urine excreted at different periods of the day, it is quite essential that to get the best results from the urine examination, a 24 hr. specimen should be examined. If the total quantity is known, then the specific gravity gives one a better notion of the total elimination of solids.

In the presence of an increase of the specific gravity of the urine due to sugar, the following rule may be of great convenience: For every increase of specific gravity of 5 points due to the sugar, there is 1% of sugar present, thus: If a diabetic urine has a specific gravity of 1.030, estimating the specific gravity without the sugar at 1.015, the 15 points increase due to the sugar would suggest the presence of 3% sugar.

It often happens that a specimen from females contains excretions, albuminous or mucous, from the vagina, which obviously leads one to a misinterpretation of the urinary findings. This is especially true during the period of menstruation. Often times trauma in passing the catheter gives rise to abnormal findings of blood, pus cells and epithelial tissue.

If the urine is allowed to stand at a moderate temperature, bacteria quickly destroy the casts and organized sediment. The addition of antiseptics may interfere with the tests one desires to make, and therefore should be known to the examiner.

TECHNICAL CONDUCT.

The sample is first shaken carefully and specimen is then poured into a 50 c.c. graduated cylinder which is set in an upturned petri-dish.

Reaction is taken with blue litmus. If there is no change in the color of the litmus, the reaction is then taken with the red litmus, and the result recorded, acid, neutral or alkaline.

The **specific gravity** is taken with the urinometer after rinsing off the bulb, wiping it dry, and removing the foam from the surface of the urine with the filter paper. Record is made of the reading at the point of contact of the surface of the urine with the scale.

Next a portion of the sample is poured into a centrifuge tube, which is given the same number as the sample. This is counter-balanced in the centrifuge, which is allowed to run until the rest of the examination is completed.

Albumen Test (Heller's). 5 c.c. of urine is poured into a test tube, to which a few drops of 10% acetic acid is added. If turbidity remains, the urine is filtered through a filter paper placed in a small funnel, previously moistened with distilled water. The urine is put into another test tube, and then with a pipette $\frac{1}{2}$ to 1 c.c. of hot nitric acid is run into the bottom of the test tube, forming an even line between the urine and nitric acid. If albumen is present, there is a precipitation of the same which gives a white or grayish line at the point of contact. (The pipette used for this purpose is made by drawing a piece of glass tubing $\frac{3}{4}$ Cm. in diameter and about 5 in. long, to a point. On the end of this is placed a piece of gum rubber tubing $2\frac{1}{2}$ in. long, in the end of which is inserted a glass plug. This makes a very convenient and delicate pipette.)

Sugar Reaction (Fehling's). For sugar test, Fehling's solution is used. This is kept on the shelf in two separate solutions, an alkaline tartrate, and a copper sulphate. Every two or three days the solutions are mixed in equal quantities, to which four times the quantity of water is added. 5 c.c. of the diluted Fehling's solution is placed in a test tube, and with the tube pointed away from the analyst the solution is brought to a boil, and a few drops of urine are added without further boiling. If sugar is present, a brownish yellow precipitate, cupric oxide, is thrown down within a minute or two. Care must be exercised not to have too large an amount of urine lest the urates present reduce the copper and give a misleading interpretation.

Indol Reaction. 5 c.c. of urine are placed in a test tube, to which is added an equal quantity of hydrochloric acid combined solution, and a few drops of hydrogen peroxide, after which about 1 c.c. of chloroform is added. After the addition of the chloroform the urine is shaken very gently, giving the chloroform a chance to take up the indoxyl sulphate, if any is present. This, as an indigo blue, settles to the bottom of the tube, and a record of its presence or absence is made.

Diazo Reaction. To 5 c.c. of sulphanilic acid, made by saturating a 5% hydrochloric acid with sulphanilic acid, add a drop of sodium nitrite. An equal quantity of urine is then added to the combined solutions and thoroughly shaken until a heavy foam is formed on the surface. To this concentrated ammonium hydroxide is added. Positive Diazo is indicated by the pink color which the foam imme-

diately takes on, and is further verified by the deep garnet of the underlying solution.

Microscopical Examination. The centrifuge tube containing the sample of urine is now taken from the centrifuge and quickly turned upside down in the sink, giving all of the urine a chance to run out. The sediment which remains in the bottom is removed by tapping the bottom of the centrifuge tube on the palm of the left hand, which thoroughly mixes the sediment with the small amount of urine that has remained in the tube. These few drops of mixed sediment are then poured on a slide and covered with a cover-glass. This is placed under the microscope, and examined without the condensor with a dim light, using the No. 1 eye-piece and the 2-3 objective. A record of the presence of casts, blood cells, pus cells, and any other pathological organized substances is made. If special quantitative examinations of the urine are desired, these are done in a special laboratory.

In the recording of the results only pathological findings are noted. Whenever more than a hundred white blood cells are present in the field, the finding is recorded as pus cells. There is also an additional examination made for the tubercle bacillus, allowing the sediment to dry on the slide and then proceeding in exactly the same way as is described for the staining of tubercle bacillus in sputum.

ROUTINE BLOOD EXAMINATION.

In literature on the examination of blood we find reference to many differences in the normal blood of children and of adults. Digestive leukocytosis lasts from one to three hours after eating, which must be differentiated from leukocytosis with fever. Mercury, iodides, and other drugs produce a leukocytosis. Starvation produces a marked change in the leukocyte count, which can easily be confused with other conditions.

The Widal reaction does not show in the blood until the seventh day, sometimes later. Some patients who have had typhoid will show the Widal throughout the remainder of their lives. Five per cent of all typhoids never show a Widal.

Malarial parasites are most numerous about eight hours after chill. The forms are more characteristic at this time. Malaria may quickly disappear after the administration of quinine. A person once having had malaria may have a recurrence afterwards.

In consideration of the results of the Wassermann test it is important to know that in primary syphilis the positive Wassermann very seldom occurs until the end of the fourth week, sometimes not even until the end of the sixth week. In the secondary state all cases should show a positive Wassermann. In the tertiary stage all untreated cases show positive Wassermann. Treated cases

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OUTLINE OF TECHNICAL CONDUCT FOR ROUTINE BLOOD EXAMINATION.

IV.

III.

II.

I.

Test.

A	Hemoglobin	Sterilize lobe of ear and pierce $\frac{1}{4}$ in. with scalpel.	Wipe off first drop of blood. Collect on Talquist paper. After 1 min. record reading.			
B	No. Red Cells		Draw fresh drop to 5 on pipette. Wipe with gauze and fill to 101 with physiological salt.	Clean counting chamber and cover glass with dry gauze. Blow off lint. Shake pipette vigorously. Force several drops of the diluted blood from the pipette. Place drop of sufficient size to just cover the field inside of the moat. Carefully place cover-glass over the counting chamber, noting that the fluid does not extend beyond moat.	Count 20 spaces across the field each way. Multiply the result by 2, and add four ciphers. Record.	
C	No. White Cells		Draw fresh drop to 5 on pipette. Wipe and with gauze. Fill to 11 with 3% acetic acid.		Count number of cells in entire field. Multiply result by 2 and add two ciphers.	
D	Differential Count of Leukocytes		Smear two slides evenly with blood.		Stain slide $1\frac{1}{2}$ min. with Wright's blood stain. Add distilled water drop by drop until precipitate forms on surface. Let stand 1 $\frac{1}{2}$ min. Rinse with distilled water. Dry with a blotter. Differentiate fifty cells. Multiply result of each variety by 2, and record result.	
E	Equipment	Scalpel Sponge Alcohol	Talquist's Hemoglobinometer Red Blood Pipette White Blood Pipette Physiological Salt Solution 3% Acetic Acid Slides Cleaned with Ether			

OUTLINE OF TECHNICAL CONDUCT FOR URINARY ANALYSIS.

Test.		I.	II.	III.	IV.	V.	VI.	VII.
A	Specific Gravity	Warm to 100° F. Pour into 50 c.c. cylinder and remove foam. Determine specific gravity with urinometer and record.						
B	Reaction	Test reaction with blue litmus and record.						
C	Albumin		Add a few drops of acetic acid to urine in test tube. Filter 2 c.c. into 5 c.c. test tube.	With a pipette place hot nitric at the bottom of urine. After 3 min. record reaction.				
D	Sugar			Heat 5 c.c. Fehling's solution in 6" test tube.	Add 3 or 4 drops of urine and let stand 3 min. Record reaction.			
E	Indol				Place 5 c.c. urine in 6" test tube. Add 5 c.c. of hydrochloric acid.	Add 5 drops hydrogen peroxide and 1 c.c. chloroform. Shake gently. Record results after chloroform settles.		
F	Diazo					Prepare 5 c.c. sulphanic acid and 2 drops sodium nitrite in 6" test tube.	Add 5 c.c. urine. Shake until heavy foam is formed.	Add ammonia to excess and record result.
G	Microscopical	After thoroughly mixing sample, place in centrifuge tube and start centrifuge.				Stop centrifuge.		Place sediment on slide and cover with cover glass. Examine and record presence of pathological findings.
H	Equipment	50 c.c. Cylinder Urinometer Bunsen Burner Red and Blue Litmus Centrifuge Tube	Acetic Acid Filter Funnel Test Tubes	Pipette with rubber bulb Nitric Acid Fehling's Solution Test Tubes	Hydrochloric Acid	Hydrogen Peroxide Chloroform Sulphanilic Acid Sodium Nitrite		Ammonia Slides and Covers Microscope

are positive or negative in proportion to the length of time treatment has been taken.

Congenital syphilis on the mother's side shows positive Wassermann during the first year. Positive reaction is less frequent when the father is syphilitic. As the child grows older the reaction may become less marked. In paralytic conditions spinal fluid may be positive when the blood is negative.

The positive reaction will disappear under specific treatment. The disappearance parallels the improvement in the symptoms usually, but may precede them. A positive Wassermann test is of great diagnostic value, but a negative test does not justify a favorable prognosis.

From the blood serum, which is taken in the same way as the blood for a blood culture or Wassermann test, the complement fixation test for gonorrhoea can also be made, and the Abderhalden tests for pregnancy and cancer. The limitations of interpretation of the complement fixation test for gonorrhoea are similar to those of the Wassermann test, and the value of the Abderhalden test, although not conclusive, is sufficiently suggestive to be worthy of routine consideration in hospital work.

The time of coagulation of blood for cases about to undergo operation is of great value, and ought to be a routine procedure for all surgical cases.

TECHNICAL CONDUCT.

The blood for the routine blood examination is taken from the lobe of the ear. This location is selected in preference to the finger for the reason that the nerve supply is very much less in the lobe of the ear than in any other part of the skin, more especially the finger, consequently there is very little pain experienced. The fingers are much more liable to be infected with tetanus or pus forming organisms than the lobe of the ear, and hence are much more difficult to sterilize.

The lobe of the ear is carefully cleansed with 95% alcohol on a sponge, and then with a small cataract knife which has previously been immersed in 95% alcohol to sterilize, the ear is pierced while pinching the lobe very tightly between the thumb and the first finger. This pressure to a certain extent anesthetizes the part. Then insert the knife about $\frac{1}{4}$ inch. The first drop is wiped off with a dry sponge, and then the hemoglobin is taken either with a Dare instrument or with a Tallquist, according to the choice of the operator.

The hemoglobin reading having been made, a red cell pipette is picked up and again the blood is wiped with a dry sponge and a fresh drop is drawn into the pipette to the .05 mark. The point of the pipette is wiped with a dry gauze, then the physiological salt solution which is slightly colored with a little eosin is drawn up

OUTLINE OF TECHNICAL CONDUCT FOR WIDAL.

Test	I.	II.	III.	IV.
A Widal	Sterilize lobe of ear and pierce $\frac{1}{4}$ in. with scalpel.	Wipe off first drop of blood. Collect large drop on end of slide and allow to dry.	Prepare 2 hanging drop slides and covers. Warm the hanging drop slides, and with wooden applicator smear vaseline evenly around the moat. On the cover mix blood diluted to ten on the hemoglobin scale, with physiological salt. 1 drop plus 1 drop of suspension of 24 hr. typhoid culture or blood serum, or agar-agar.	Prepare control by using same suspension of typhoid bacilli mixed with equal size drop of physiological salt on the cover. Examine with 1.6 objective without condenser. Set aside for 15 min. to 1 hr. before recording result.
B White Count		Draw fresh drop to 5 on pipette. Wipe end with gauze. Fill to 11 with 3% acetic acid.		Clean counting chamber and cover-glass with dry gauze. Blow off lint. Shake pipette vigorously. Force several drops of blood from the pipette. Place drop of sufficient size to just cover the field inside of the moat. Carefully place cover-glass over the counting chamber, noting that the fluid does not extend beyond the moat. Count number of cells in entire field with 2.3 objective without condenser. Multiply result by 2, and add two ciphers.
C Differential Count		Smear two slides evenly with blood.		Stain slide $1\frac{1}{2}$ min. with Wright's blood stain. Add distilled water drop by drop until precipitate forms on surface. Let stand $1\frac{1}{2}$ min. Rinse with distilled water. Dry with a blotter. Differentiate fifty cells with 1-12 oil immersion objective with condenser. Multiply result of each variety by 2, and record result.
D Equipment	Sterile Sponges 95% Alcohol Scalpel	Slides White Blood Pipette 3% Acetic Acid Solution	Hanging Drop Slides Cover Glasses Vaseline Platinum Wire N-10 Salt Solution Typhoid Culture Blood Serum Gram Culture Tube	Counting Chamber Wright's Blood Stain Distilled Water Blotters

OUTLINE OF TECHNICAL CONDUCT FOR WASSERMANN.

Factors of Test.	Explanation.	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX. X.	
Amboceptor	Rabbit serum immunized to sheep corpuscles.			Dilute with .9 salt solution 1-1000.	.25	Incubate one hour to determine strength of complement which equals X.	Activate corpuscles by mixing equal quantities of amboceptor and sheep blood in 20 c.c. Test Tube.				Add .5 c.c. activated corpuscles to each tube including controls, and shake.
Sheep Corpuscles	Red blood cells of sheep.	Draw 10 c.c. blood from sheep	Wash with .9 salt solution and concentrate with centrifuge.	Dilute with .9 salt solution 1-20.	.25						
Antigen	Alcoholic Extract of Syphilitic Liver.			Dilute with .9 salt solution one-half amount amboceptor 1-10.	.0		Front Back Tube Tube 1 2 3 4 .25 .0 .5 .0 .25 .25				
Complement	Serum of guinea pig.	Draw 10 c.c. blood from guinea pig	Separate serum with centrifuge.	Dilute with .9 salt solution 1-10.	1 2 3 4 5 6 7 8 .35 .30 .25 .20 .15 .10 .5 .0		X X X X X .0	Incubate at 37° C. 1 hr.			
Antibodies	Serum of patient.	Secure 5 c.c. blood from patient	Separate serum. Place 1 c.c. in 5 c.c. test tube.	Incubate 30 min. at 55° C.	.0		.05 .1 .0 .0 .0 .0				
Reagents & Equipment	Burrows Welcome Immune Rabbit Serum Sheep Blood Alcoholic Syphilitic Liver Extract Guinea Pig Blood Serum of Patient	Pipette Petri Dish	Wash Bottle Wax Pencil Centrifuge Tubes 1 c.c. Pipettes		Salt Solution 1 2 3 4 5 6 7 8 .5 .55 .6 .65 .7 .75 .8 .85		.25 .5 .0 .5 .25 .5 Salt Solution.				
Set up one row of eight tubes, each with factors as indicated.						Incubate 2 hrs.					
Mark and set up in two rows, two tubes for each serum, and two for negative and two for positive controls. Set four tubes in front for blanks.						Record as positive all tubes in which hemolysis in the front tube has been delayed or is not present, expressing the degrees of hemolysis as X, XX, XXX, XXXX.					

Adapted from Wood's "Chemical and Microscopical Diagnosis".

to the 101 mark on the pipette. This is shaken. The white pipette is filled in the same way except that a 5% acetic acid solution slightly colored with methylene blue is used to make the dilution.

Two slides which have previously been washed with alcohol and ether and dried with a clean cloth, free from fat, are then selected to make an examination for differential count. A drop of blood is placed on one end of one of the slides, and the end of the other slide immersed in it, and when the blood spreads to both sides it is drawn down the full length of the first slide, thus making an even, thin smear of blood. The same is repeated on the second slide, using the first slide for smearing the blood.

If a Widal is desired, a drop of blood is secured on a third slide and allowed to dry. Always when a Widal is taken a white count and differential count should be made. This practice gives one a chance to check the typhoid culture, that is, whenever a positive Widal is found with a very high white count, one suspects the culture and an examination is made to determine its purity. Also the reverse of this situation, a low white count and a negative Widal makes one suspicious of the culture and its purity is investigated.

For complement fixation test, a needle is inserted into the vein, the arm having been previously cleaned with iodine or alcohol and ether, and the blood is caught in a centrifuge tube, the end of which is immediately plugged with a sterile gauze sponge.

For Wassermann test, exactly the same procedure is used.

For malaria the examination is made from a study of the slide obtained for the differential count.

If a blood culture is desired, the blood is secured as for a complement fixation test, and a flask of bouillon is inoculated with a portion of the blood thus secured.

A counting of the blood from the pipette is made by first wiping the surface of the counting chamber carefully with a dry, clean gauze. Then wipe the cover in the same way. Thoroughly shake the red blood pipette and allow four or five drops to run out. Then place a drop in the center of the counting chamber, which will just cover the surface inside of the moat. Put the cover glass over this by grasping it at the corners and holding the fingers so they come outside of the slide, letting one side down and then the other. After this preparation has stood for three or four minutes, allowing the corpuscles to settle to the bottom of the chamber, the count is made by counting forty of the small squares, beginning at the bottom and going up to the top, counting between two lines, and then beginning at the middle of one side and crossing to the other. Estimation is then made from the result of this count by multiplying the result by 20,000.

The white count is accomplished by making the same kind of a preparation from the white cell pipette, and counting the entire field, using a 2-3 objective, and multiplying the result by 200.

Differential count is made by staining with Wright's stain. Flood the slide with the Wright's stain for $1\frac{1}{2}$ minutes. Then add distilled water a drop at a time until a bronze surface appears. Then wash with distilled water and dry with a blotter. A most accurate and most simple method is to take one hundred peas in one's hand, and while passing the slide under the microscope, note the different classes of white cells and drop into evaporating dishes marked with the different classes one of the peas when a cell of each class appears. Then when the hundred peas are gone, a hundred cells have been counted, and by counting the number in each dish, one gets the percentage. For routine work one hundred cells is sufficient. However, if the count shows any peculiarities, a more accurate differential count may be desirable, in which case two or four hundred should be counted.

In searching for malaria the same slide is used, and a careful search of the red cells for parasites is sufficient.

Widal is accomplished by diluting the dry blood to a point that corresponds to about 10 on the hemoglobin scale. A drop of this is mixed with an equal portion of the suspension of freshly cultured typhoid bacilli. These are suspended in a hanging drop sealed with vaseline. A control is made by mixing the suspension of typhoid germs with an equal quantity of salt solution or tap water. The two are then placed in a petri-dish and covered, and looked at with the microscope every five or ten minutes until coagulation takes place, or until an hour has elapsed.

Blood Culture. 5 c.c. of blood is mixed with 100 c.c. or more of neutral bouillon, and allowed to stand in the incubator for 24 hours. The suspension is examined for bacteria according to the methods described for inflammatory exudates.

STOMACH ANALYSIS.

Some general precautions as to the time of taking stomach contents ought to be noted in connection with the analysis of the stomach. In the analysis of stomach contents, we find that a more characteristic secretion of the stomach is obtained when the test breakfast is taken at the same hour at which the patient usually has his breakfast. It is customary to withdraw the test breakfast after digestion has proceeded for one hour. Changes in secretion, due to nervous excitement, are less liable to occur under these conditions.

If a constriction is present, a sacculated condition of the esophagus may occur and part of the food may never have reached the stomach. If the stomach tube does not pass beyond the constriction, results in the analysis of the material would obviously be very misleading. The same is true if diverticulum were present and the tube entered this instead of the stomach. When information relative to the counter indications for passing the

OUTLINE OF TECHNICAL CONDUCT FOR STOMACH ANALYSIS.

Test		I.	II.	III.	IV.
A	Meal	Give one piece of dry toast without butter and one cup of tea without sugar or cream. Withdraw in fifty minutes.			
B	Physical Examination	Place in a tall cylindrical glass container in ice box until separation into layers takes place.	Note character and proportion of layers, odor, color, presence of mucous, pus, masses of tissue and blood.		
C	Microscopical Examination	Make unstained cover glass preparation and examine with 2-3 and 1-6 objectives for cellular elements.	Prepare and stain masses of purulent mucous for tubercle bacillus.	Stain a second slide of sediment with Loeffler's methylene blue and Lugol's solution. Note and record presence of bacteria, starch granules, yeast and epithelial cells.	
D	Reaction	Determine reaction immediately after withdrawing contents, with Congo red and litmus.			
E	Free Hydrochloric Acid		Measure with pipette 10 c.c. into 5 c.c. evaporating dish.	Titrate with 10 normal sodium hydroxide, using dimethylamindoazobenzol as indicator.	Multiply result by 10 and record.
F	Total Acidity		Measure with pipette 10 c.c. into 5 c.c. evaporating dish.	Titrate with 10 normal sodium hydroxide, using phenolphthalein.	Multiply result by 10 and record.
G	Combined Hydrochloric Acid		Measure with pipette 10 c.c. into 5 c.c. evaporating dish.	Titrate with 10 normal sodium hydroxide, using alizarin as an indicator.	Subtract result from phenolphthalein titration and multiply by 10.
H	Organic Acids				Subtract the sum of the free hydrochloric and combined hydrochloric from the total acidity.
I	Blood		Measure 15 c.c. into large test tube. Add 5 c.c. glacial acetic acid to 15 c.c. of ether.	Shake	Pour off 2 c.c. ethereal extract and combine with 1 c.c. tincture of gualiac and 1 c.c. of ozonized turpentine, and record result.
J	Equipment	50 c.c. Cylinder Ewald Aspirator Slides and Covers	10 c.c. Pipettes 3 50 c.c. Evap. Dishes 6" Test Tube	Stirring Rod Moore's Burette	
K	Chemicals	Congo Red Paper Litmus Paper	Carbolfuchsin 10% Sulphuric Acid Sat. Sol. Picric Acid Glacial Acetic Acid Ether Alcohol Tr. Gualiac	Loeffler's Meth. Blue Lugol's Solution N-10 Sodium Hydroxide Phenolphthalein Alizarin Dimethylamindoazobenzol	

stomach tube has been obtained some time previous to the actual passing of the tube, especially if the information can be obtained without the patient having the knowledge of the reason for desiring the information, the patient is much less nervous and the tube can be passed much more easily.

The more important counter indications for passing the stomach tube are, muscular or valvular diseases of the heart, aneurism, advanced pulmonary tuberculosis, apoplexy, recent hemorrhage from the stomach, pregnancy or menstruation.

TECHNICAL CONDUCT.

The patient is given an Ewald test breakfast, preferably at the regular time that patient is accustomed to take breakfast. This is removed with an Ewald aspirator at the end of fifty minutes. Before attempting to remove the test breakfast, a stomach tube is placed for five or ten minutes in ice water. A rubber apron is placed around the neck of the patient and he is given a towel. Then the patient is seated in a stiff-back chair, or a stool against the wall, the tube is passed, and having been inserted the proper distance, the patient is requested to strain. At the same time the bulb of the aspirator, which has been collapsed previous to attaching to the end of the tube, is held by the one drawing the stomach contents. When sufficient contents is passed through the tube to make an analysis, the tube is removed. One must notice carefully the eye of the tube to see if blood clots or some pieces of tissue have remained.

Immediately the contents is taken to the laboratory and the reaction is tested, both with Litmus and Congo red, and a record of the reaction made. Then if a little delay in making analysis is necessary, the contents may be placed in the ice box. When the examination is again taken up, the examiner must observe the physical condition of the contents; whether the sediment is finely divided and completely digested, whether the supernatant fluid is clear, and the nature of the surface of the fluid. If masses of mucous, especially purulent mucous, or if blood clots are observed, or portions of tissue, these should be examined bacteriologically for tubercle bacillus with the same method described for sputum.

The supernatant liquid is poured off into two 15 c.c. centrifuge tubes and centrifuged. From the two tubes when centrifuged 20 c.c. of the clear contents can be withdrawn, which is divided into two portions of 10 c.c. each and placed in 50 c.c. evaporating dishes. The liquid can be measured either with a graduated cylinder or with a 10 c.c. pipette, preferably a pipette.

One dish is titrated with tenth normal sodium hydroxide and dimethylamidoazobenzol as an indicator, which when added to the contents turns it pink. The titration is carried until the solution becomes a canary yellow. Then to the same dish phenolphthalein is added and titrated until it becomes a deep pink. The first titra-

tion gives the free hydrochloric acid. The second titration plus the first titration gives the total acidity.

The second dish is now titrated with tenth normal sodium hydroxide, using alizarin as an indicator. The addition of the alizarin turns the liquid to a yellowish brown. The titration is carried until the liquid becomes a brownish purple. This titration is subtracted from the total acid, which gives the combined acid. The free hydrochloric acid plus the combined acid, subtracted from the total acid, gives the organic acids. For convenience of working out the quantity of different acids in the stomach contents, the following equations may simplify the understanding.

Let the alizarin titration be represented by "A", the phenolphthalein titration by "B", and the dimethylamindoazobenzol titration by "C", then

Free Hydrochloric Acid	=C
Organic Acids	=B—(C+(B—A))
Combined Hydrochloric Acid	=B—A
Total Acids	=B

Microscopical. Smear slides. Stain with 10% Lugol's solution. Examine, stained and unstained. Look for epithelial cells, red blood cells, pus cells, fragments of tissue from tumors, parasites, bacteria yeast. Note carefully the presence of purulent mucous which will be present on the surface of the contents. This ought to be examined for tubercle bacillus following the technique described for sputum. A further microscopical examination is made by smearing some of the sediment on a slide, allowing it to dry, and staining it by the method described for diphtheria. In securing the mucous for examination for tubercle bacillus, it is often quite desirable to use the petri-dish.

Ocult Test for Blood. (Webber.) Measure 15 c.c. of unfiltered contents to large test tube. Add 5 c.c. of glacial acetic acid to 15 c.c. of ether. Add this to the large test tube containing the stomach contents. Shake frequently for 15 minutes. Pour off 2 c.c. of the ethereal extract and combine with 1 c.c. tincture of guaiac and 1 c.c. ozonized turpentine. If blood is present, the solution turns a purple color, which can be extracted by shaking with chloroform and water.

MILK EXAMINATION.

In routine work the complete quantitative estimation of the proteid and sugar and total solids is time consuming, and requires a very elaborate outfit. It therefore behooves the laboratory worker in executing his work for the physician's use in judging the quality of milk as to its desirability for feeding infants, to shorten his method as much as possible. If the specific gravity is normal and the fat is normal, then the total solids are undoubtedly normal unless there should be a marked increase in the proteid and corresponding decrease in the sugar, or vice versa, in order

to get a normal specific gravity. As this is very unlikely, one can judge very well the quality of milk by the specific gravity, fat and the microscopical examination.

The best results in analysis of milk are obtained when we keep in mind that the relative quantities of fat, sugar and proteid at different hours in the day vary considerably. This is especially true in nervous patients. It is, therefore, important in securing a sample for analysis to get a homogeneous sample of the milk secreted during the 24 hr. period. This can be done by combining the entire day's secretion and sending a sample of the whole, or by making a composite sample of all of the pumpings through the 24 hr. period.

OUTLINE OF TECHNICAL CONDUCT FOR MILK.

Test		I.	II.
A	Specify Gravity	Shake sample vigorously Pour into 50 c.c. cylinder and take specific gravity with urinometer. Record.	
		Measure with a Babcock pipette 16½ c.c. into Babcock test bottle. Add sulphuric acid specific gravity 1.81 sufficient to coagulate and redissolve casein, shaking vigor- ously after addition of each 2 or 3 c.c.	Place in centrifuge 3 min. Fill with hot water to the top. Run centrifuge 2 min. Get length of fat column with dividers and read by placing dividers on zero mark and above. Record percentage.
B	Fat		Centrifuge in ordinary centrifuge tube 10 c.c. after addition of 5 c.c. of ether well shaken. With fine pipette take up sediment from the bottom, wipe the outside with gauze saturated with ether. Make cover glass preparation. Ex- amine stained and un- stained, and record pres- ence or absence of crys- tals, bacteria and pus cells.
C	Microscopical		
D	Chemicals and Equipment	16½ c.c. Pipette. Babcock milk test bottle Babcock cream test bottle Sulphuric acid 1.81 sp. gr.	Dividers Centrifuge Cover glass and slides Loefer's methylene blue stain Logul's solution

The specific gravity of the milk is taken with a urinometer in the same manner as described for urine.

The fat is estimated by the Babcock method, which is accomplished by taking 17.6 c.c. of milk and placing it in a Babcock milk test bottle graduated to ten per cent. Add a sufficient amount of concentrated sulphuric acid of specific gravity 1.82 to coagulate and redissolve the casein. It requires from 10 c.c. to 16 c.c. of the acid to do this. Place the test bottle in the centrifuge and run for three minutes. Add hot water to the neck of the bottle and run for two minutes. Fill up to the ten per cent mark with hot water and run again for two minutes. Then get the length of the

butter fat column by measuring from the zero mark to ten per cent of fat as measured with a pair of compasses. This reading should be taken when the temperature of the milk is about 140° F.

For microscopical examination 15 c.c of milk are centrifuged for ten minutes in an ordinary centrifuge tube. The sediment is removed from the bottom with a pipette. After removing the cream from the top with a filter paper, push the pipette to the bottom, keeping the finger over the end. Stir carefully the sediment and allow about ½ c.c. to run into the pipette. Again place the finger over the end, withdraw the pipette and wipe off whatever fat is present on the outside. Then examine sediment under the microscope with a cover glass placed over, as in examining the sediment of urine. Note the presence or absence of colostrum crystals: the approximate number of pus cells and epithelial cells. Then remove the cover glass and allow the sediment to dry, fix in ether, and stain with Wright's blood stain.

A second slide prepared in the same way can be examined for tuberele bacillus. This gives much information in regard to the bacteriological content.

FECES.

The examination of feces is always made after having received a history of the case, which will give the analyst information in

OUTLINE OF TECHNICAL CONDUCT FOR FECES.

Tests		I.	II.
A	Parasites	Dilute to liquid consistency with physiological salt and place in incubator until temperature is 37½°C.	pour into cover of petri-dish about 5 c.c. Place petri-dish bottom down in cover. Examine with 2-3 objective, after removing mechanical stage, and record findings.
B	Ameba		Make cover glass preparation. Examine with 1-6 objective on a warm stage.
C	Bacteria		Mix thoroughly 5 c.c. with distilled water. Sediment in centrifuge. Examine by Gram's method, and for tuberele bacillus on slide preparations.
D	Blood		Test by Webber's method as described for Stomach Contents.
E	Equipment		Normal Salt Formaldehyd T. b. Staining Solution Gram's Staining Solution Glacial Acetic Acid Ether Tr. Guaiac Turpentine Slides and Covers Petri-dish Platinum Wire Test Tube

regard to the class of tests which should be made on any particular sample, unless a specific request is made for certain examinations.

The following routine examinations are done: Parasites, ameba, bacteria and blood.

A slide preparation with a cover glass, diluted with normal salt solution, is examined on a warm stage with a 1-6 objective for the ameba coli, buccalis, etc.

Bacteriological. A small amount of the feces is stained with the Gram's method, and a record of the types of organisms is made. Also a specimen is always stained for tubercle bacillus.

The chemical test for blood is the well known guaiac and ozonized turpentine. This is made by adding a few drops of freshly prepared guaiac and 20 or 30 drops of ozonized turpentine to the ethereal extract of the stool. If blood is present, the ether assumes a purple color, which can be extracted by shaking up with chloroform and water.

A control tube using a small amount of blood is necessary in making a test of occult blood.

BACTERIOLOGICAL EXAMINATIONS.

When an examination of the **sputum** is made and one finds positive tubercle bacillus, the result is of great diagnostic importance. If, however, tubercle bacilli are not found, one is in no way justified in a favorable prognosis. Until a great many examinations have been made of a 24 hr. specimen with negative results, one cannot feel certain of the absence of the germs in the sputum. It is very important that a 24 hr. specimen be examined each time.

In specific **urethritis** in a male, very seldom do we find contamination of organisms. The reverse is true in the examinations of the secretion of female urethra. It is therefore of great value to the examiner to have the knowledge of the sex of the individual from whom the specimen has been secured. In negative urethritis in the male, often times the diagnosis can only be made from secretions forced by massage from the prostate gland. These, as a rule, contain fewer pus cells and fewer specific organisms.

The anatomical location of the inflammation of the specimen of **inflammatory exudates** is of great assistance in examining these exudates, as one can be guided considerably by this knowledge in the choice of stains to be applied. This is especially true when only a single slide is submitted for examination.

In securing a specimen from a suspected case of **diphtheria**, it is exceedingly important that the swab be applied to the edge of the advancing membrane. If only a hyperemia is present the swab should be thrust into the crypts of the tonsils. With this character of examinations, as with others mentioned, a negative report does not justify a favorable prognosis nor does it relieve the attending physician of responsibility, unless the clinical symptoms accord with



EAST END OF GENERAL LABORATORY

EXUDATES.

Test.	I.	II.	III.	IV.	V.	VI.	VII.
A Sputum		Place collected sample in petri-dish.	With a platinum wire isolate thinned caseous or bloody particles on a slide. Smear this evenly between two slides, warming slides sufficiently to hasten evaporation.	Fix both slides with heat.	Stain with warmed carbolfuchsin 3 min. Wash and decolorize with 10% sulphuric acid. Wash and differentiate with picric acid. Do not wash but remove excess picric acid with blotter.	Examine for tubercle bacillus with 1-12 oil immersion using condenser.	
B Urethral Discharge		Smear specimen of pus thinly on slides.		Fix with heat.	Stain 30 sec. with methylene blue. Rinse and dry with blotter.	Examine with 1-12 oil immersion using condenser. Record presence or absence of pus cells intercellular diplococci and relative number of other bacteria.	If in doubt, stain by Gram's method, and examine for decolorized intercellular diplococci with 1-12 oil immersion, using condenser.
C Spirochaeta		Prepare specimen by forcing exudate from inflamed surface by exerting sufficient pressure to cause serum to exude.	Take up on a slide one drop of serum and mix with one drop of India ink. Smear evenly over the slide.	Dry in air.		Examine for spirochaete with 1-12 oil immersion.	
Inflammatory Exudates							
D Pus Forming Organisms	Make cultures on Loeffler's blood serum and repeat examination after 24 hrs. incubation at 37° C.	Smear samples on slides.		Fix with heat.	Stain with methylene blue.	Examine with 1-12 oil immersion.	
E Tonsillar Exudates	Make cultures on Loeffler's blood serum and repeat examination after 24 hrs. incubation at 37° C.	Make preparation on slide by touching the slide with the swab.			Stain 30 sec. with Loeffler's methylene blue. Rinse with water and stain 30 sec. with Lugol's solution. Rinse and dry with blotter.	Examine with 1-12 oil immersion.	
F Alveolar Exudates		Collect sample with platinum wire from around decayed teeth and suspicious areas of the mouth.	Make unstained preparation on slide with cover-glass in physiological salt solution. Seal edges of cover-glass with vaseline.			Examine with 1-6 objective on warm stage.	
G Equipment	Test Tubes Sterile Swab Tongue Depressor Sterile Applicator Loeffler's Blood Serum	Slides Petri Dish Platinum Loop Sterile Sponge Cover Glasses Vaseline	India Ink Physiological Salt		Carbolfuchsin 10% Sulphuric Acid Picric Acid Filter Paper Loeffler's Meth. Blue Lugol's Solution	Warm Stage.	Aniline Oil Sat. Gentian Violet 95% Alcohol 1% Eosin

the negative findings. When negative reports have been made and the clinical indications still persist, repeated examinations should be ordered.

In ulcers of the mucous membrane of the mouth, we find frequently spirochaetes resembling *pallida*. In primary lesions the surface often times becomes secondarily infected and unless exudate from a deeper tissue is obtained, we can not hope to find the specific organisms.

SPUTUM.

Smears of the sputum are made by placing a considerable quantity of the suspicious material on a slide. By dragging one slide over the other, keeping both warm, until the moisture is entirely evaporated, very thick smears can be made. Then fix with heat. Stain with hot carbolfuchsin for three minutes, wash under the tap, decolorize in 10% sulphuric acid, and wash again. Then counter-stain with picric acid, and dry with a blotter without rinsing.

Examine for tubercle bacillus, which appear as bright reds on a smooth, even yellow background.

URETHRAL DISCHARGE.

Make smears direct from the discharge as it issues from the urethra or from the Bartholin gland. At least three smears should be made. These are fixed with heat, and one is stained for one minute with a water solution of methylene blue. The second is stained by the Gram's method, the application of which is made with freshly prepared reagents. (One drop of gentian violet saturated in absolute alcohol in 10 drops of water saturated with aniline oil.) Stain for three minutes. Dry with blotter. Apply Lugol's solution for three minutes. Rinse with 95% alcohol until decolorized. Counter-stain with eosin and dry with a blotter without rinsing.

The diagnosis of gonococcus depends:

First, on having secured the smear from a suspicious mucous membrane.

Second, from the presence of pus cells, which ought to be numerous.

Third, from the presence of diplococci in the field.

Fourth, from the presence of diplococci which are intracellular.

Fifth, from the presence of diplococci which are Gram-negative.

The third slide should be stained with Loeffler's methylene blue and counter-stained with Lugol's solution.

INFLAMMATORY EXUDATES.

Exudates are smeared on slides, fixed with heat, stained with methylene blue, and counter-stained with Lugol's solution. They should be secured sterile and cultured on Loeffler's blood serum for examination if required.



SPECIAL LABORATORY

Three slides should be made, one to be stained as above, a second to be stained for tubercle bacillus as described for sputum, and a third to be stained with Gram's method if necessary.

In the case of exudates in which there is a suspicion of the presence of *spirochaeta pallida*, the inflamed area is carefully cleaned with a dry piece of gauze, and then with pressure the clear serum is pressed from the raw surface. A drop of this is collected on the slide, to which a drop of India ink is added and carefully mixed with the corner of another slide. Then a second slide is used to smear the mixture in the same way that a blood film is smeared. After it becomes dry it is examined for the *spirochaeta pallida*.

TONSILAR EXUDATES.

Tonsilar exudates are secured on sterile applicators. If a membrane is present, the edge of the membrane is loosened. If there is no membrane, the applicator is thrust into the crypts of the tonsils. A direct smear is made from the applicator on a slide sterilized in the flame. The applicator is then placed in a Loeffler blood serum tube, the surface of which is smeared and allowed to remain, placing the tube in the incubator from 16 to 24 hours. The slide is examined at once, after having been stained with Loeffler's methylene blue and counter-stained with Lugol's solution, applying the methylene blue for $\frac{1}{2}$ minute, washing and applying the Lugol's solution $\frac{1}{2}$ minute. (Epstein Method.)

A second slide is examined for tubercle bacillus.

If diphtheria bacilli are not found on the direct smear, the culture is examined at the end of 16 or 24 hours, by making smear on slides and staining in the same matter.

ALVEOLAR EXUDATES.

Microscopical examination of the secretions around the teeth are made by preparations stained with India ink as for *spirochaeta pallida*, also with methylene blue and Lugol's solution. An unstained preparation is made on a slide and covered with a cover glass, after the material is diluted with saline. This is examined on a warm stage for *entameba buccalis* and protozoa.

LABORATORY FOR SPECIAL WORK.

The laboratory for special work is a private laboratory for the Pathologist in charge of the Scientific Department. In this room I take care of the odds and ends of technical troubles and classification.

The room, besides being equipped for the routine tissue examinations, Abderhalden test, Luetin test, autogenous vaccines, blood pressure, Wassermann tests, complement fixation test, and blood cultures, is also provided with a hood, an analytical balance, distilling apparatus, and all of the more important clinical bacteriological, pathological, and physiological equipment. It is here that I make and dispense the reagents for the routine work.

FRESH TISSUE METHOD.

"1. Fresh tissue, the cells of which must be alive (i. e., if not kept in the ice chest, not more than two hours out of the body) in bits not more than 2x10x10 mm. is frozen in dextrine solution on a good microtome and cut in sections 5 to 15 microns thick.

"2. Remove the sections from the knife with the tip of the finger and allow them to thaw thereon, thus avoiding later development of air bubbles.

"3. Unroll the sections in 1 per cent Na Cl solution.

"4. Stain 10 to 20 seconds in *Unna's* polychrome methylene blue, *Grubler's*.

"5. Wash out momentarily in 1 per cent Na Cl solution.

"6. Mount in *Brun's* glucose medium. Formula: Glucose 240 c.c., distilled water 840 c.c., spr. camphor 60 c.c., glycerine 60 c.c., filter.

"The Spencer automatic microtome with CO₂ attachment and vulcanite insulating plate, gives excellent sections. Handle the sections from first salt solution through to slide with a small glass rod lifter. Keep the sections constantly moving while in the stain. The smaller the stain cup the more readily tissue may be found in it if dropped from the lifter. If fluids for unstained sections are in clear glass over a black background, and those for stained sections are in white porcelain or clear glass over a white background, the work will be much facilitated. The various tissue elements are sharply contrasted in red, purple and dark blue. Even mitotic figures, where present, are many times beautifully shown. The sections, of course, fade as they die and decompose. Formaldehyd-fixed material, first thoroughly washed in tap water, may be treated in exactly the same manner as fresh tissue. The color differentiation is materially different, but the process is of great convenience for the rapid examination of a great number of blocks from a given specimen."*

Certain classes of tissue which cannot be handled as above, such as mucous polyps, etc., can be quickly sectioned in paraffine by the following method:

Sections are cut through the portion of the tissue it is desired to examine, and placed in 4% formaldehyd for two hours to harden. Then in 50% alcohol two hours, 95% absolute alcohol 10 minutes, xylol 10 minutes, melted paraffine 10 minutes. Mount on wooden blocks.

The sections, which are floated on warm water, are fixed on slides with a fixatif and dried. Then the paraffin is dissolved with xylol, the xylol is removed with absolute alcohol, immersed in 95% alcohol and then in water; stained with hematoxylin and eosin, dehydrated with 50%, 95%, and 100% alcohol, cleared with xylol, and mounted in balsam.

*Mayo Pathological Laboratory.

TISSUE.

Test

I

II.

III.

A	History	Obtain complete clinical history of the patient.		
B	Frozen Section	Select suspicious portions of tissue from gross specimen.	Place portion $\frac{1}{4}$ in. thick on stage of freezing microtome. With camel's hair brush surround with sufficient normal salt to fill the crevices beneath. Freeze and section 10 to 25 u. thick. Remove from knife with finger and place in normal salt.	Transfer on bent teasing needle and stain with polychrome meth. blue for 20 sec. Rinse in normal salt. Mount with Brown's mounting solution and examine.
C	Interpretation			Record classes of tissue, arrangement of cells, and make diagnosis, being guided by history.
D	Permanent Mount	Immerse in 4% formaldehyde		Use collodion or paraffine method.
E	Gross Specimen			Immerse 5 days in Kaiserling No. 1, changing the position of specimen frequently. Drain and place in 80% alcohol 6 hrs. and 95% alcohol 2 hrs. and preserve in exhibition jars with Kaiserling No. 2.
F	Equipment	Razor Blade 4% Formaldehyde	Freezing Microtome Camels Hair Brush Normal Salt Solution	Teasing Needle Polychrome Meth. Blue Brown's Mounting Solution Slides and Covers Kaiserling No. 1 Kaiserling No. 2 80% Alcohol 95% Alcohol Specimen Jars

MOUNTING PATHOLOGICAL SPECIMENS.*

For the preservation of specimens ordinarily a 4% solution of formaldehyd answers the purpose, and it is our custom to use this solution, but for the fixing of specimens for museums, the Kaiserling method is used, for which method we keep in stock two solutions; the fixation solution in which the specimens are immersed for five days, consisting of:

Formaldehyd	200 c.c
Water	1000 c.c
Nitrate of Potassium.....	15 grams
Acetate of Potassium.....	30 grams

Change the position of the specimen frequently, using rubber gloves to protect the hands from the injurious effect of the formaldehyd. The time of fixation varies with the tissue or organ and size of the specimen.

Drain and place in 80% alcohol one to six hours, and then in 95% alcohol for one to two hours to restore the color, which is somewhat affected in the fixing solution.

Preserve in

Acetate of Potassium.....	200 grams
Glycerin	400 c.c.
Water	2000 c.c.

Exposure to light gradually affects the colors. The process of fixation should be performed in the dark, and the specimens when preserved should be kept in the dark except when on exhibition.

If it seems desirable to cut a thin slice from the face of a specimen, this should not be done until the preparation has been in the preservative fluid two weeks. The specimen may then be placed in alcohol for one to two hours to brighten up the colors.

It is advisable to add camphor, thymol, carbolic acid (1%), or some other preservative to the third solution to prevent the growth of molds.

TUBERCULIN TEST.

Von Pirquet's Reaction. The skin of the inner aspect of the forearm is first cleansed with ether. Two drops of tuberculin are then placed on the skin about four inches apart. With a needle or other suitable instrument, previously sterilized by heat, the skin is gently scarified, first midway between the drops, and then within each drop. A small tuft of cotton wool is placed on each drop for about ten minutes. No subsequent dressing is required. In scarifying there is no need to draw blood.

In tuberculous cases a small red papule, surrounded by a hyperaemic area of vivid red color about the size of a florin, usually appears toward the end of 24 hours at the site of inoculation.

*Adapted from Mallory & Wright's "Pathological Technique".



SCIENCE LECTURE ROOM.

AUTOGENOUS VACCINE.

VI.

V.

IV.

III.

II.

I.

Make emulsions in normal salt from each variety of colony. Count by Wright's method and combine making total quantity up to 20 c.c. Sterilize in oven at 70° for 24 hrs. Add 5% trikresol and seal with rubber cap.

Make slant streaks from each variety of colony of non-sporeforming organisms.

Make stained preparations and examine each characteristic colony.

Incubate 24 to 72 hrs. at 37½°C.

Collect sample on sterile applicators with sterile platinum wire or hypodermic needle from the localized lesion.

Autogenous Vaccine

Normal Salt Solution
Pipette
Wright's Blood Stain
Trikresol
Test Tubes with rubber caps

Methylene Blue Noxy Culture Chart.
Slides & Covers.

Sterile Applicators
Platinum Wire
Scalpel
Aspirating Needle

Equipment

A

B

LUETIN TEST.

Cleanse the site chosen with soap and water, or alcohol.

Shake contents of ampoule down into large end before opening. File ampoule at shoulder, break off tip and draw contents into syringe.

The emulsion is always injected intradermally, that is, not subcutaneously, but into the skin as superficially as possible. If the emulsion is injected under the skin, positive reaction will not follow. When the injection is carried out successfully, the epidermic layer is raised from the deeper layers of the skin and is sharply defined. A hypodermic syringe with a needle of small calibre is used for the injections which are made in the antero-internal surface of the arm. From 0.04 to 0.05 c.cm. of the suspension are injected.

THE RELATION OF THE INTERNE SERVICE TO THE LABORATORY.

In the organization of the interne service in the Hospital, one interne is always stationed in the laboratory, and does his work directly under my supervision. He is officially a junior to the senior on medical service. Thus, before going on to the medical service he becomes familiar with all the routine procedures of the laboratory, knowing just where this work is done and how, and understanding perfectly its limitations, which is the primary reason for giving an interne service in connection with the laboratory. He, therefore, in his future work in the Hospital, is in a position to utilize the laboratory to its utmost.

By having the laboratory arranged with special desks for each class of work, and having the internes on their senior services familiar with the laboratory technique and its convenient arrangement, it is of great advantage to them to be able to make, from time to time, special tests, or any emergency test on a patient. When he comes to the laboratory to do this, the desk for the routine work of that class is turned over to him temporarily, and the work is done under my supervision.

The records are made in the same way and inspected and filed, as all other routine work leaving the laboratory.

DEPARTMENT OFFICE



PART III.

SYSTEM OF MAKING AND FILING RECORDS.

Financial Record.

A special office is set aside for the purpose of taking care of the records. The records are numbered serially and are made in duplicate by placing a sheet of carbon between two blanks, fastened together at the bottom with OK clips, which are easily removed when the record is completed.

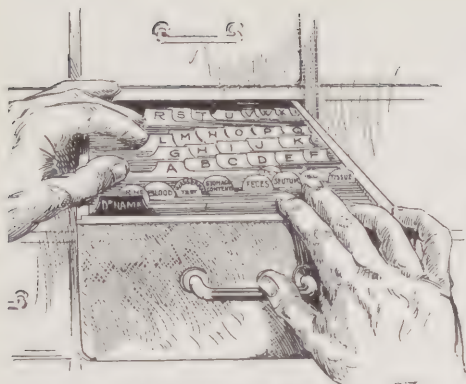
When a specimen is brought to the laboratory the person whose duty it is to make this record first gives the specimen the serial number of the record. The record is then filled out as indicated by the blanks. For this purpose records are made for laboratory reports as on page 69, for tissue reports as on page 70, and for radiographic work as on page 67. The specimen, together with the record blank, is then placed on the desk set aside for this special examination.

When the examination has been completed the record is returned to the laboratory office and the financial record is made. This consists of a duplicate blank, page 71. These blanks are made out in one of two colors, white or pink, all charity cases being filled out on pink slips. One of these is retained in the laboratory office and the other is sent to the main office.

If the laboratory work has been done on a patient in the Hospital, then the fee indicated on this financial record is charged to the patient's house account. If the patient pays for the examination, a receipt is made out on the special petty ledger leaf used for this purpose. If the patient is an out-patient and payment is not made, then the charge is transferred from the financial record to the petty ledger.

Going back to the other records, one copy of the record is sent to the room and the other copy is filed in a serial file. If the patient is not in the house, the copy of the record is mailed to attending physician.

These records are indexed in the following manner. Each physician who sends work to the laboratory appears in the index with his name on a red major guide card. His laboratory work is recorded on one of a set of small tabbed cards, illustrated on page 66, his X-ray work is recorded on a set of blue indexed cards, and his correspondence on a set of white cards. If the records show that there is pathological condition present, the pathology is indicated on the corner of the record and filed under its proper classification, this classification being made on major green guide cards. The



ARRANGED INDEX

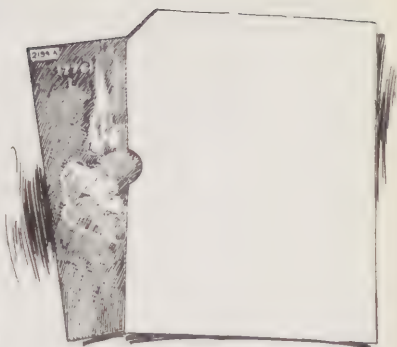


PLATE ENVELOPE

record is also filed under the name of the patient, the card of the patient carrying the number of the archive envelope, and also the serial number of each laboratory record.

X-ray plates are treated in the same way as the X-ray record, or laboratory record, except that they are filed serially in the special file room prepared for them.

ST. JOHN'S HOSPITAL

Serial No. _____

X-Ray Diagnosis

[Name: _____ Index Under
Dr: Pathology _____]

Date _____ Name _____ Dr _____ Room _____

Residence _____

Age of patient, _____ ; Sex, _____ ; Occupation, _____ ;

Civil State, _____ ; Size, _____ ; Employer, _____

FAMILY HISTORY

PREVIOUS HISTORY

PRESENT ILLNESS OR INJURY

Gout, Rheumatism, Syphilis, Tuberculosis, Alcoholism, Nervous Affection, Cancer and Family Deaths.

Habits, Occupation, Diseases of Childhood, Venereal History, Rheumatism, Gout, Tuberculosis, Malaria, Typhoid, etc.; Previous Similar Attacks, Previous Injury (Dates), Complications and Sequels.

Disease: Time and Mode of Attack; *Injury:* Time, Part or Parts, Mode of Production, Symptoms, (Shock, Deformity, Impairment or Loss of Function, Hemorrhage), Ability to Walk. *Other Abnormal Conditions:* Time and Manner of Occurrence, Course, Treatment Previous to Admission.

ANATOMICAL X-RAY RECORD.

Pathological Anatomy Due to:—Tumors, Fractures, Ulcers, Scars, Deformities, Infiltrations, Accumulations of Fluids, Foreign Bodies.

X-Ray Plate Nos. _____

PHYSIOLOGICAL X-RAY OBSERVATIONS.

Pathology of Function Demonstrable in:—Respiratory Tract, Digestive Tract, Circulatory System, Urinary Tract, Skeleton.

M. D.
Pathologist.

SERIAL NO. .

Index Under
Name: Dr: Pathology

Date Name Dr. Room

Residence

Age of patient, _____; Sex, _____; Occupation, _____.

Civil State, ; Size, ; Employer,

PREVIOUS HISTORY

Gout, Rheumatism, Habits, Occupation, Diseases of Syphilis, Tuberculosis, Childhood, Venereal History, Rheumatism, Gout, Tuberculosis, Malaria, Typhoid, etc.; Nervous Affection, Cancer and Family Deaths. Previous Similar Attacks, Previous Injury (Dates), Compli-

OR INJURY

Disease: Time and Mode of Attack; *Injury:* Time, Part or Parts, Mode of Production, Symptoms, (Shock, Deformity, Impairment or Loss of Function, Hemorrhage), Ability to Walk. *Other Abnormal Conditions:* Time and Manner of Occurrence, Course. Treatment Previous to Admission.

[illegible]

.....M. D.
Pathologist.

CLINICAL REPORT OF ST. JOHN'S HOSPITAL

Laboratory Report

Date..... Name..... Dr..... Room.....

URINE

Sp. Gv.....
 Reaction.....
 Albumen.....
 Sugar.....
 Indol.....
 Diazo.....
 Microscopical.....

Usual physical or chemical findings.....
 Remarks:

BLOOD

Hemoglobin.....
 No. red cells.....
 No. white cells.....
 Differential count of white cells.....
 Polymorphonuclear leucocytes.....
 Small lymphocytes.....
 Large lymphocytes.....
 Eosinophiles.....

Complement Fixation Test for Gonorrhoea.....

Wassermann Test.....
 Widal.....
 Malaria.....
 Blood Culture.....

STOMACH CONTENTS

Test Meal.....
 Given.....A. M.P. M.
 Removed.....A. M.P. M.
 Physical examination.....
 Microscopical examination.....
 Reaction to.....
 litmus.....
 Congo red.....
 Free Hydrochloric acid.....
 Organic acids.....
 Total acidity.....
 Combined hydrochloric acid.....

MILK

Sp. Gv.....
 Fat.....
 Microscopical.....

FECES

SPUTUM

URETHRAL DISCHARGE

INFLAMMATORY EXUDATES

Source.....
 Findings.....

TONSILAR EXUDATES

Swab.....
 Culture.....

TISSUE TUMORS, ETC.

Source of Tissue.....
 Diagnosis.....

RABIES

ABDERHALDEN TEST

TUBERCULIN TEST

LUETIN TEST

BLOOD PRESSURE

AUTOGENOUS VACCINE

Source of bacteria.....
 Kind of bacteria.....

RADIOGRAPH

No. of Plate.....

REMARKS:

..... M. D.
 Pathologist.

ST. JOHN'S HOSPITAL

Tissue Diagnosis

Date..... Name..... Dr..... Room.....

Age of patient, ; Sex, ; Occupation,

Predisposing and hereditary history

Anatomical source of tissue

General and local pathological changes

Immediate indications for removal

Rapidity and duration of growth

Base of attachments of tumor

Gross description and measurements

Histo-pathology

Diagnosis

.....M. D.
Pathologist.

Pathological Department.

RECORD OF EXAMINATION

Date

Name

Physician

Examination of

Fee		
-----------	-------	-------

.....
Pathologist

No.

Pathological Department.

RECORD OF EXAMINATION

Date

Name

Physician

Examination of

Fee		
-----------	-------	-------

.....
Sister.

No.

Pathological Department.

RECORD OF EXAMINATION

Date

Name

Physician

Examination of

Usual Fee		
-----------------	-------	-------

Discount for

Fee Charged

.....
Pathologist

No.

Pathological Department.

RECORD OF EXAMINATION

Date

Name

Physician

Examination of

Usual Fee ...		
---------------	-------	-------

Discount for

Fee Charged

.....
Sister.

No.

DIRECTIONS FOR SENDING SPECIMENS.

URINE.

Send about 4 ounces of urine, to which has been added a small piece of camphor gum. Pack carefully so that the container will not be broken, and accompany same with the following information:

- Is the sample a representative portion of a 24 hr. specimen?
- What was the total quantity of the 24 hr. specimen?
- Was the total quantity well shaken before this specimen was taken?
- Is the patient male or female?
- If a female, is she menstruating or has she a vaginal discharge?
- Is the sample a catheterized specimen?
- How long has the specimen been standing and at what temperature?
- Has an antiseptic been added to this sample? If so, what?

BLOOD COUNTS.

Blood for cell counts must be taken from the patient direct and cannot be sent by mail. Blood for differential count of leukocytes is taken and a smooth, even smear made on a slide, which has been washed in ether and dried. Preparation having been made from a fresh drop of blood is sufficient. This should be accompanied with a large drop of blood placed on one end of the slide from which a Widal test can be made. The following information should be given:

- What is the age of the patient?
- How long after eating was blood specimen secured?
- Is the patient receiving normal nourishment?
- Is the patient running a temperature?
- How many days since the onset of the disease?
- Has the patient ever had typhoid fever?
- How long ago?
- Do you suspect malaria?
- If so, how long after chill was specimen taken?
- What medication is the patient receiving?

STOMACH CONTENTS.

Stomach contents is taken after patient has received a test meal. Clinical condition of the patient must guide the attending physician in regard to the test meal given. Contents, if not taken from the patient at the laboratory or brought to the laboratory within an hour or two afterwards, ought to be packed in ice. It should be accompanied with the following information:

- What is the usual hour for the patient to have breakfast?
- What time was the test meal given?
- What was the character and quantity of the meal given?
- Has the patient any of the following counter indications for passing the stomach tube: Muscular or valvular diseases of the heart, aneurism, advanced pulmonary tuberculosis, apoplexy, recent hemorrhage from the stomach, pregnancy or menstruation?

Specimens for Bacteriological Examination should be collected in a sterile container.

Specimens for Diphtheria Examinations should be collected in a sterile cotton swab, and placed in a sterile bottle, or test tube, unless a tube or box of culture media has been furnished.

BLOOD FOR WASSERMANN REACTION.

At least 5 c.c. of blood should be mailed in a sterile syringe or bottle which was dried and free from chemicals of any kind before the blood was taken. This should be accompanied with the following information:

Is there a distinct history of syphilitic infection in the patient?

What is the date and location of the primary lesion?

Has the patient had secondary lesions?

If tertiary lesions appeared, what are the character of the same?

Has the patient had any of the following diseases: Scarlet fever, framboesia, tubercular leprosy, trypanosomiasis, noma, malaria, or recently undergone an anaesthetic?

Specimens of Tissue for Microscopical Examination should be placed in 4% formaldehyd immediately after removing, and shipped in a large mouth bottle, accompanied by the following information:

Age of patient.

Sex.

Occupation.

Predisposing and hereditary history.

Anatomical source of tissue.

General nature of pathological changes.

Indications for removal.

Rapidity of growth.

Duration of growth.

Gross appearance of surrounding tissue.

Base of attachment.

Gross description of tumor.

SPUTUM.

Sputum should be put in a large mouth 2 ounce bottle, to which has been added a small amount of 5% carbolic acid. The following information should accompany specimen:

Is the specimen a 24 hr. sample?

Is it a first or second sample from this patient?

What has been the result of previous examinations?

Do you desire information relative to other findings than tubercle bacillus?

PRICES TO PATIENTS CURRENT IN ST. JOHN'S HOSPITAL FOR WORK DONE IN THE SCIENTIFIC DEPARTMENT.

URINE

Routine urine for anesthetics	\$ 1.00
Routine urine, complete qualitative and quantitative estimations..	5.00

BLOOD

Routine blood examination complete.....	5.00
Single estimation of red cells, white cells or differential count....	2.00
Wassermann Test	5.00
Complement fixation test for gonorrhea.....	5.00
Widal Test	2.00
Malaria	2.00
Blood Culture	5.00

STOMACH CONTENTS, routine analysis.....	5.00
--	-------------

MILK	3.00
-------------------	-------------

FECES	5.00
--------------------	-------------

SPUTUM	2.00
---------------------	-------------

URETHRAL DISCHARGE	2.00
---------------------------------	-------------

INFLAMMATORY EXUDATES	2.00
------------------------------------	-------------

TONSILAR EXUDATES	2.00
--------------------------------	-------------

TISSUE	5.00
---------------------	-------------

RABIES	10.00
---------------------	--------------

ABDERHALDEN TEST	5.00
-------------------------------	-------------

TUBERCULIN TEST	2.00
------------------------------	-------------

LUETIN TEST	3.00
--------------------------	-------------

BLOOD PRESSURE	1.00
-----------------------------	-------------

AUTOGENOUS VACCINE	5.00
---------------------------------	-------------

RADIOGRAPHS

Extremities, teeth or head.....	5.00
---------------------------------	------

Shoulder or hips	10.00
------------------------	-------

Spine, chest, abdomen or pelvis.....	15.00
--------------------------------------	-------

RADIOSCOPIC STUDY without plates.....	10.00
--	--------------

COMPLETE RADIOSCOPIC AND LABORATORY STUDY OF CASE..	25.00
--	--------------

For cases entering the hospital in charge of physicians who avail themselves of our interne service, a fee of \$1.50 is made to the patient for routine laboratory work. This consists of one or more, or all of the following tests repeated as often as the physician in charge or the interne in charge desires while the patient is in the house: Routine urine, routine blood examination, routine stomach examination, routine feces, routine sputum, urethral discharge, inflammatory exudates, tonsilar exudates, tuberculin test, blood pressure.

For patients not entered by a physician who has accepted our interne service, the regular fee as in schedule above will be charged.

The above fees are subject to discount for charity only on authority of Mother Superior.

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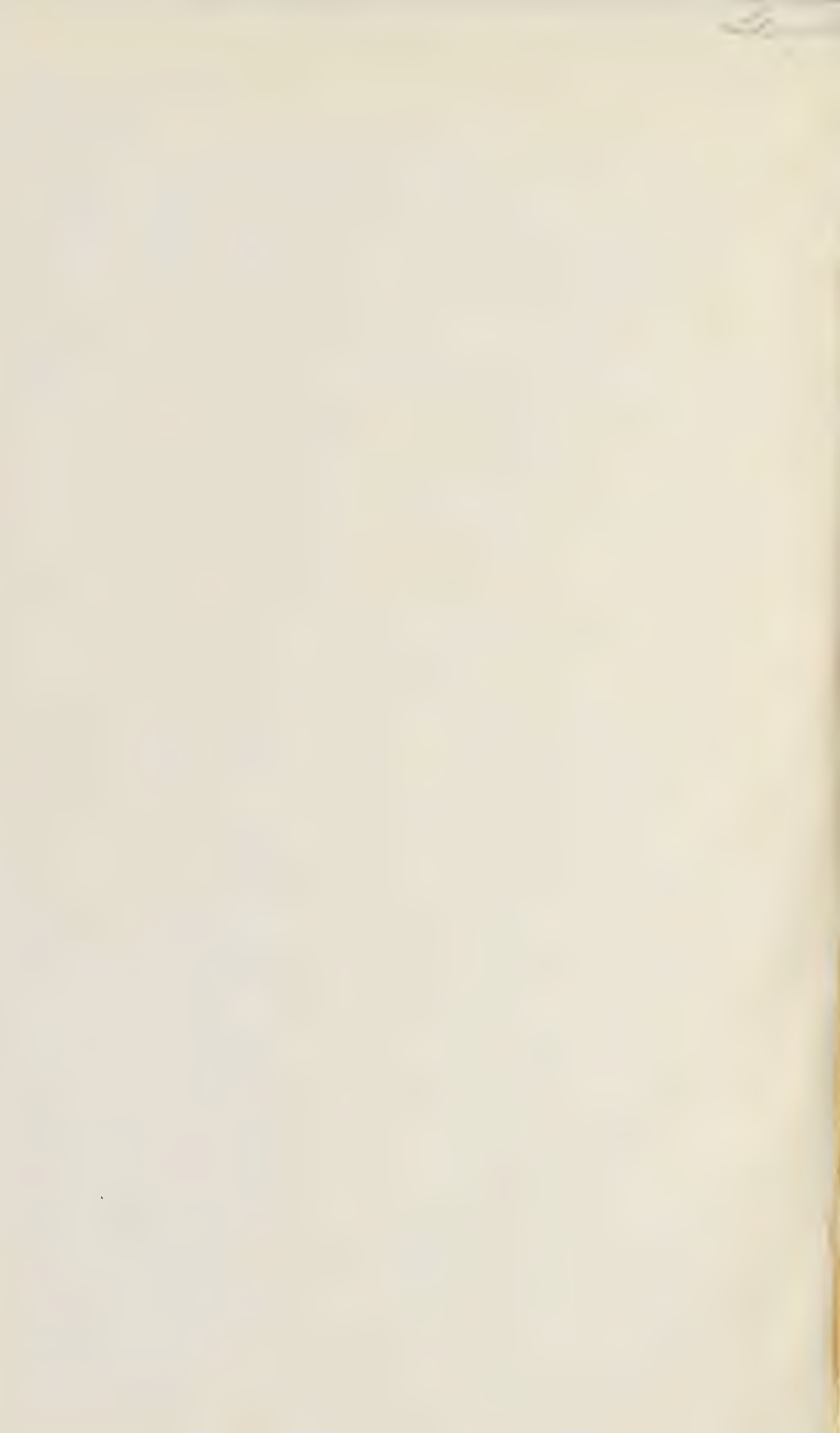
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